UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Florida Keys National Marine Sanctuary
33 East Quay Road
Key West, FL 33040

Florida Keys National Marine Sanctuary
Resource Assessment Survey Protocols for Nearshore Construction Projects

I. Introduction

All species of stony coral (Class Anthozoa, Subclass Hexacorallia, Order Scleractinia), hydrocorals (Class Hydrozoa), black corals (Class Anthozoa, Subclass Ceriantipatharia, Order Antipatharia) (hereafter referred to as "stony corals"), and sea fans (species *Gorgonia ventalina* and *G. flabellum*) are prohibited for collection or disturbance throughout the 2900 square nautical mile Florida Keys National Marine Sanctuary (FKNMS or sanctuary). In addition, many other living sanctuary resources contribute to the ecological value of the area and are protected by sanctuary legislation. As such, any projects that have the potential to disturb or destroy stony corals, sea fans, or other organisms require review and approval from FKNMS.

To facilitate review of proposed projects, FKNMS may require that a thorough resource survey of the project area be completed by a biologist skilled in marine invertebrate identification, specifically coral assessment and identification to the species level, and who holds the necessary FKNMS permit to conduct such survey activities. The placement of items on the seafloor while conducting benthic surveys, such as quadrats, measuring tapes, and PVC pipe, is prohibited by FKNMS regulations. Conducting prohibited activities without the required permit constitutes a violation of Federal laws and is subject to possible enforcement action. Information on how to obtain FKNMS permits to conduct benthic survey activities may be found at https://floridakeys.noaa.gov/permits/welcome.html?s=management.

Resource surveys that are incomplete, incorrect, or found to be inadequate by FKNMS staff will be addressed via a Request for Additional Information through the appropriate permitting agency, possible agency site visit(s) for ground-truthing surveys, discussion with consultants or biologists, and possible other actions. These measures may result in delays in FKNMS review and approval for projects.

Complete resource surveys are intended to provide FKNMS staff, permitting/regulatory agency personnel, and contractors with the necessary information to determine an accurate, cumulative loss of resources that would result from a project. Accurate documentation of the abundance, distribution, location, and status of important resources (i.e., soft corals/octocorals, stony corals, hydrocorals, sponges, seagrasses, macroalgae communities, mangroves) provides baseline data from which the condition of resources may be assessed post-construction.

Resource surveys are also intended to provide information on coral rescue and relocation options for any given project. Upon review of each project, FKNMS staff will assess which corals are viable candidates for rescue or relocation based on their species, size, morphology, condition, location, and other relevant factors. FKNMS may require a Coral Rescue or Relocation Plan for project sites with corals that are appropriate for temporary or permanent relocation.

II. Survey timing

1) Seagrass surveys in Florida should be conducted from June 1 through September 30 (seagrass growing season) per the National Marine Fisheries Service, Southeast Region Habitat Conservation Division's *Science-based Seagrass Survey Window for Coastal Construction Project Planning in Florida* (May 2010; Attachment 1) and Florida Department of Environmental Protection's *Guidance on Surveys for Potential Impacts to Submerged Aquatic Vegetation* (December 2020; Attachment 2). If resource surveys occur outside of this window, FKNMS may require that the site be re-surveyed during the seagrass growing season. For large projects (e.g., basin dredging, marina redevelopment, beach renourishment), surveys during the seagrass growing season will be required. Applicants should confer with FKNMS staff as necessary about the specifics of their project to determine the appropriate timing of the survey.
2) In the event that construction does not occur within three years, or if an existing resource survey is older than three years, FKNMS may require a re-survey to accurately assess the project area and provide relevant information for updated mitigation calculations. FKNMS may also require a re-survey if changes in environmental conditions warrant (e.g., after a coral bleaching or disease event or other major disturbance such as a hurricane).

III. Survey methods – Overall site

1) Conduct a comprehensive resource survey of the entire project footprint, including all areas that will undergo construction (e.g., direct footprint of dock access walkways, terminal platforms, seawalls, rip rap revetment, pilings or pile pairs, boat lifts, mooring piles, floating docks or ramps, and any support structures). If existing structures are slated for removal or repair, survey all surfaces being removed/repaired (e.g., bulkheads/seawalls, pilings, fenders, posts – whether cement, metal, wood, plastic or other materials, concrete blocks or "sand bags"). Ensure that algae or seagrass covered surfaces and areas of all structures and the seafloor are gently "fanned" to reveal corals that may be underneath or hidden.
2) Survey a buffer area a minimum of 10 feet beyond the immediate footprint where construction activities will occur (5' radius around piling) to account for indirect impacts from barge spudding, pile driven fracturing of substrate, turbidity curtains, etc. It is advised that surveyors review construction plans with the project engineer or design agent prior to the benthic survey so an adequate buffer area can be incorporated into the benthic survey and potential coral relocation plans. Applicants should confer with FKNMS staff as necessary about the specifics of their project to determine the appropriate buffer area to survey. This information will also aid in discussion of avoidance strategies where they may be available, such as an overall spud placement prohibition or spud placement outside of resource areas. For large projects (e.g., basin dredging, marina redevelopment, beach renourishment), a larger buffer area may be required for surveying.
3) Survey adjacent areas of the project site/submerged lands, outside the proposed footprint, to assess whether alternate locations for the structure with fewer resource impacts may exist. A general description of the entire riparian property should be provided in the benthic survey report with an assessment as to whether the proposed location contains the least resources and is therefore most appropriate for the structure.

IV. Survey methods – Species and habitat assessment

1) Document **all** stony corals, seagrasses, mangroves, and other invertebrates such as soft coral/octocoral (e.g., sea fans, sea whips, sea plumes, sea rods), sponges, submerged aquatic vegetation (SAV)/macroalgae, fauna, etc. regardless of size, by genus (and species name when known) and dimensions/area. Follow the additional instructions in this section for enumerating and measuring invertebrates, plants, and trees.
2) For projects where stony coral, soft coral/octocoral, and sponge species are too numerous to count individually, provide an estimate of impacts using a scientifically-defensible method. Applicants should first confer with FKNMS staff about the proposed estimation method based on the specific details of their project. FKNMS may have additional requirements for large projects such as temporary installation of reference markers, etc. Any selected methodology for coral/invertebrate surveys should document the number, size of each individual (cm^2), and the total area (cm^2) for each coral species or invertebrate group. Any selected methodology for seagrass and SAV should delineate the beds, document species present, and provide % cover. Options include, but are not limited to, the following:
    a. Accurately determine and mark each piling / pile pair location (for docks). Survey the proposed pile footprints plus buffer (5' radius around piling). Individually enumerate resources within those exact footprints/buffers and provide total.
    b. Estimate cover using a stratified random sampling design. Classify entire survey area into distinct habitat types through an initial survey (e.g., sand, seagrass, hardbottom), then survey at least 25% of each habitat type using randomly-placed m^2 quadrats (e.g., 400 m^2 seagrass = 100 random m^2 quadrat surveys). Individually enumerate resources within quadrats and extrapolate to project area for each habitat type (e.g., cm^2 coral per m^2; % cover seagrass per ft^2/m^2). Use extrapolated figures to estimate impact in each habitat type.
    c. Estimate cover using linear a transect method. This works best for projects with an obvious linear dimension such as a dock access walkway.
    d. Ensure that any required buffer area is similarly surveyed to account for impacts outside of the project footprint (e.g., barge spudding), if applicable.
    e. Regardless of which estimation method is employed, survey data should be used to extrapolate the total estimated impacts to stony coral, soft coral/octocoral, and sponges. The total estimated number of stony corals, soft corals/octocorals, and sponges shall be binned by size class as explained in #3(d) and #4(b) of this section.
3) Stony coral dimensions should be provided as follows:
    a. Small, flat corals (<10 cm max. dimension and <1 cm high): Calculate the area (cm^2) as L x W.
    b. Small, mounding corals (<10 cm max. dimension and ≥1 cm high): Calculate the area as in c, below.
    c. Large mounding corals (≥10 cm max. dimension): Measure L, W, and H. Next, calculate the area (cm^2) using the formula for an ellipsoid then divide the result in half (since corals are a dome, not a sphere). Use the ellipsoid calculator at http://www.smartconversion.com/unit_calculation/Surface_area_of_an_Ellipsoid.aspx. Carefully review the black and white diagram on the website to be sure the values input into the on-line calculator (represented as *a*, *b*, and *c* in the diagram) are correct. For the on-line calculator, *a* is equivalent to half the length (radius #1) of the colony, *b* is equivalent to half the width (radius #2) of the colony, and *c* is equivalent to the full height of the colony. Ensure the end result from the calculator is divided in half.

An Excel spreadsheet with the correct formulas input for quick calculations using coral colony L, W, and H may also be used; contact FKNMS for Excel sheet.

d. All corals: Using the maximum dimension (cm), bin all stony corals using the following size classes: 0 to <5 cm, 5 to <10 cm, 10 to 19 cm, and additional 10 cm size classes (e.g., 20 to 29 cm, 30 to 39 cm, etc.) as necessary, to include all resources. Provide totals in all size classes.
e. All corals: If any bleached or diseased corals are observed, all dimensions per a-d above should be provided, but bleaching/disease state should be noted in the benthic survey report. Should diseased corals be observed, recommended decontamination guidelines may be found at https://floridakeys.noaa.gov/coral-disease/citizen-participation.html

4) Soft coral/octocoral and sponge dimensions should be provided as follows:
   a. Measure the two greatest dimensions in cm (e.g., W and H, L and W). Provide both the individual dimensions and the area (cm^2).
   b. Using the maximum dimension (cm), bin all soft corals/octocorals and sponges using the following size classes: 0 to <5 cm, 5 to <10 cm, 10 to 19 cm, and additional 10 cm size classes (e.g., 20 to 29 cm, 30 to 39 cm, etc.) as necessary, to include all resources. Provide totals in all size classes.
5) Document, quantify(percent cover per species per area, and shoot density), and map (provide total area as ft^2 and m^2) all seagrass species within the project footprint and buffer area. Survey methodologies should follow guidance found in Section 2.0 of the Florida Department of Environmental Protection's *Guidance on Surveys for Potential Impacts to Submerged Aquatic Vegetation* (December 2020; Attachment 2).
6) Document, quantify (ft^2 and m^2), and map all mangroves and buttonwoods by species within the project footprint and buffer area.
7) Document the presence of any Endangered Species Act threatened or endangered species or designated critical habitat and whether essential features are present.
8) Ensure that the area is thoroughly surveyed to document whether hardbottom meeting the definitions in the U.S. Army Corps of Engineers Jacksonville District's Biological Opinion (JAXBO) and/or South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (2020 SARBO) is present. Hardbottom is defined by the JAXBO in two ways:
   a. Natural consolidated hard substrate that is suitable to support corals, coral larval settlement, reattachment and recruitment of asexual coral fragments. These areas of hardbottom or dead coral skeleton must be free from fleshy or turf macroalgae cover and sediment cover.
   b. Nearshore and surf-zone, low-profile hardbottom outcroppings (e.g., worm-rock reef [sabellariid worm reefs] and eolianite, granodiorite). This habitat can be persistent or ephemeral, cycling through periods of exposure and cover by sand. The range of this hardbottom habitat extends along the southeastern coast of Florida from Cape Canaveral to Miami-Dade County and in the U.S. Caribbean. It is an important developmental habitat for juvenile hawksbill and green sea turtles, which use it for both foraging and refuge.

   Hardbottom is defined by the 2020 SARBO as:
   a. As substrate of suitable quality and availability to support larval settlement and recruitment, and reattachment and recruitment of asexual fragments. "Substrate of suitable quality and availability" is defined as natural consolidated hard substrate or

dead coral skeleton that is free from fleshy or turf macroalgae cover and sediment cover.

9) Collect representative photographs of individual coral colonies, or clusters of coral encrustations, and other resources observed. Photo-documentation of large, prominent colonies and/or areas of dense cover are recommended. Photograph quality must be of acceptable resolution to facilitate agency review.
10) If prehistoric or historic artifacts, such as pottery or ceramics, projectile points, dugout canoes, metal implements, historic building materials, or any other physical remains that could be associated with Native American, early European, or American settlement are encountered at any time within the project site/survey area, cease all survey activities and contact the Florida Department of State, Division of Historical Resources (DHR), Compliance Review Section at (850) 245-6333 and the FKNMS Maritime Archaeologist at (305) 434-9384. Project activities shall not resume without verbal and/or written authorization from DHR and FKNMS. In the event that unmarked human remains are encountered during survey activities, all work shall stop immediately and the proper authorities notified in accordance with Section 872.05, Florida Statutes.

V. Description of impact assessment, minimization and avoidance of impacts, and relocation efforts

1) Record the total quantity and area (cm^2) of stony coral within the project footprint and buffer area as follows:

   In direct impact (project footprint) area:

   a. Total number and area (cm^2) by species of corals that are on natural substrate that will be impacted and cannot be relocated (provide justification for why relocation is not viable);
   b. Total number and area (cm^2) by species of corals that are on structures being repaired/replaced that will be impacted (e.g., corals on a seawall or piles being removed), including collapsed structures being removed, and cannot be relocated (provide justification for why relocation is not viable);
   c. Total number and area (cm^2) by species of corals that are candidates for relocation or rescue (e.g., on natural rocks that can be moved, on seawalls where the coral morphology supports relocation, including collapsed structures being removed), refer to the Florida Fish and Wildlife Conservation Commission (FWC) Coral and Octocoral Mitigation Relocation Recommendations (FWC Recommendations; Attachment 3; contact FWC directly to obtain most current version);
   d. Total number and area (cm^2) by species of corals that are located on debris that is not part of the project (e.g., materials such as pipes, tires, concrete blocks).

   In buffer area:

   e. Total number and area (cm^2) by species of corals that are on natural substrate that cannot be relocated and provide an assessment of whether relocation or marking and avoidance with post-construction fate tracking is recommended;
   f. Total number and area (cm^2) by species of corals that are candidates for relocation or rescue, and provide an assessment of whether relocation or marking and avoidance with post-construction fate tracking is recommended;
   g. Total number and area (cm^2) by species of corals that are located on debris (include corals on debris in the buffer area and entire riparian area).

2) Document any additional debris present at the site that is not captured in the coral assessment above. FKNMS will typically require that all debris be removed.

3) Record the total quantity and area (cm^2) of soft corals/octocorals and sponges within the project footprint and buffer area, explain whether impacts are anticipated to those species and why/why not, note which organisms should be marked and avoided, and note which are candidates for relocation.
4) Provide all data using Excel spreadsheets or tables in the survey report. FKNMS may require data in Excel format for projects with numerous resources.

VI. Survey report components

1) The objective of the resource survey and associated report is to present potential threats or injury (direct or indirect) to sanctuary resources found within or adjacent to the project footprint. Use the FKNMS Resource Survey Assessment Report Checklist to aid in preparing the resource survey report (Attachment 4). A resource survey report should include, at a minimum:
   a. Site description and location (GPS coordinates (decimal degrees) and street address);
   b. Methods used for surveying site and assessing potential resource impacts;
   c. Explanation of areas surveyed, areas not surveyed, and rationale for both;
   d. Data from sections III, IV, and V and associated tables, species lists, etc. to clearly articulate all resources documented;
   e. Clear rationale for why corals are not recommended for relocation (if applicable);
   f. Map of project site with locations of the area surveyed and clearly delineating the locations of stony corals, seagrasses, mangroves, and other invertebrates such as soft coral/octocoral, sponges, macroalgae/SAV, fauna, etc. in relation to the proposed work;
   g. A general description of the entire property with an assessment as to whether the proposed location contains the least resources and is therefore most appropriate for the structure and a summary discussion of all resources that will be impacted and recommendations for avoidance and minimization strategies to prevent or reduce impacts;
   h. Photos of individual coral colonies, or clusters of coral encrustations, and other resources observed. If corals are too abundant to document each individual, photo-documentation of large, prominent colonies and/or areas of dense cover are recommended. Photo quality must be of acceptable resolution to facilitate agency review;
   i. Photographs of any cultural or historical resources present.

VII. Example survey tables

Provided below are examples of species inventory tables that may be used in reporting to FKNMS. Tables 1 through 4 should be included in the benthic survey report. Field survey raw data are not required for submission in the survey report; however, FKNMS may request raw data at any time to support project reviews so it is strongly recommended that a consistent field documentation approach be utilized.

Table 1. Stony coral, soft coral/octocoral, and sponge species by abundance and size class for organisms within the [fill as necessary and describe the specific location, e.g., direct impact area/project footprint, buffer area, etc. Use different tables for different project areas as needed to clearly elucidate which resources are located where]. Maximum dimension of each colony in cm. [add additional columns for corals larger than 49 cm in 9 cm increments]

	SIZE CLASS (cm)						
	0 to 5	6 to 10	11 to 19	20 to 29	30 to 39	40 to 49	TOTAL
SPECIES							
Favia fragum		200					200
Siderastrea radians		75	20	2			97
Gorgonia ventalina		350	56	1			407
Xestospongia muta		50	40	25	1		116
TOTAL by size class		675	116	28	1		820

Table 2. Stony coral, soft coral/octocoral, and sponge relocation recommendation summary.

	Total Number (coral colonies/organisms) candidates for relocation	Total Area (cm^2) to be relocated	Total Number (coral colonies/organisms) not candidates for relocation	Total Area (cm^2) not candidates for relocation	Total Number (coral colonies/organisms) located on debris	Total Area (cm^2) located on debris
SPECIES						
Favia fragum	200	4,294	0	0	0	0
Siderastrea radians	2	556	95	4,340	5	40
Gorgonia ventalina	12	190	395	6,278	0	0
Xestospongia muta	90	6,537	26	8,494	0	0
TOTAL by size/area	304	11,577	516	19,112	5	40

Table 3. Seagrass presence: Seagrass species, area, and density.

Species	Area (ft^2)	Area (m^2)	Percent Cover	Shoot Density (# shoots per quadrat)
Syringodium filiforme	107.6	10	25%	5
Halodule wrightii	322.9	30	25%	7
Thalassia testudinum	538.2	50	75%	15

Table 4. Mangrove and/or buttonwood presence: Mangrove and/or buttonwood species area.

Species	Area (ft^2)	Area (m^2)
Rhizophora mangle	1,076	10
Avicennia germinans	322.9	30
Laguncularia racemos	107.6	10
Conocarpus erectus	107.6	10
Conocarpus erectus var. *sericeus*	107.6	10

VIII. Partial list of references

Coral area calculations:
http://www.smartconversion.com/unit_calculation/Surface_area_of_an_Ellipsoid.aspx

Coral monitoring:
http://people.uncw.edu/millers/CoralReef_Home.htm
https://www.agrra.org/coral-reef-monitoring/
http://www.frrp.org/DRM%20PRESENTATIONS.htm
https://pubs.er.usgs.gov/publication/96224
https://www.coris.noaa.gov/activities/reef_managers_guide/

Species identification:
http://www.frrp.org/DRM%20PRESENTATIONS.htm
https://www.agrra.org/training-tools/coral-training/
http://www.fishid.com/

Seagrass monitoring: http://seagrass.fiu.edu/

IX. Attachments

1) National Marine Fisheries Service, Southeast Region Habitat Conservation Division's *Science-based Seagrass Survey Window for Coastal Construction Project Planning in Florida* (May 2010)
2) Florida Department of Environmental Protection's *Guidance on Surveys for Potential Impacts to Submerged Aquatic Vegetation* (December 2020)
3) Florida Fish and Wildlife Conservation Commission (FWC) Coral and Octocoral Mitigation Relocation Recommendations (FWC Recommendations; contact FWC directly to obtain most current version)
4) FKNMS Resource Survey Assessment Report Checklist 30NOV2022
5) Stony coral area calculator (ellipsoid calculator) spreadsheet (contact FKNMS for Excel sheet)

A Science-based Seagrass Survey Window for Coastal Construction Project Planning in Florida

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Abstract

A variety of construction activities occur in or near estuarine and coastal waters of Florida within habitats that may support seagrass. Resource managers have a need for a science-based seagrass survey window for Florida to ensure that habitats are adequately mapped and characterized prior to authorizing the destruction or modification of the habitat. The development of a survey window requires a balance between physical factors that maximize the ability to detect seagrass during sampling (essentially water clarity) and the time of year that supports peak biomass and distribution. Of the seven seagrass species found in Florida, two species exhibit greater seasonality: *Halophila decipiens* and *Halodule wrightii*. Several publications were synthesized that refer to the seasonality of seagrass. Based on this review and consultation with leading seagrass scientists, surveys for these seagrass species should occur June 1 through September 30. Results from surveys conducted outside this window will require careful evaluation given the likelihood that seagrass distribution or extent is underrepresented. This recommendation differs from but is not in conflict with recommendations from NMFS Protected Resources Division for Johnson's seagrass, *Halophila johnsonni*, which exhibits a life history that makes year-round sampling less problematic than it is for *Halophila decipiens* and *Halodule wrightii*. Because *Halophila decipiens* and *Halodule wrightii* are within the range of *Halophila johnsonii*, conducting surveys within the June 1 to September 30 window could eliminate the need for multiple surveys.

Introduction

Seagrass communities along the coasts of Florida are located in estuaries, lagoons, canals, and waterways, in addition to offshore oceanic areas. Many areas along the coasts of Florida are highly urbanized. South Florida[1] is home to nearly 9.5 million people (US Census Bureau, 2000), many of which live within three miles of the coast. This results in physical stress to coastal habitats, a phenomena that is being repeated worldwide (Waycott et al., 2009). Impacts to seagrass habitats can be caused by a variety of coastal construction activities, including but not limited to fiber optic cable installation, maintenance dredging, new channel dredging, marina expansion, and dock construction. Watercraft also can injure seagrass through propeller washing, propeller scaring, vessel shading, anchoring, and groundings (e.g., see Engeman et al., 2008; Sargent et al., 1995). These activities can adversely affect seagrass habitats by direct elimination (dredging), burial, habitat fragmentation, and physiological stress caused by degraded water quality (i.e., elevated turbidity levels). Such injuries result in a loss of ecological services, thereby disrupting normal seagrass ecosystem function and negatively affecting the numerous seagrass-dependent species that utilize the habitat as essential fish habitat for shelter, feeding, growth, and reproduction.

Several federal, state, and local environmental mandates, rules, and policies require avoidance and minimization of seagrass impacts prior to the consideration of permitting or licensing impacts to seagrass. Demonstrating seagrass avoidance and minimization in the coastal construction planning phase is

[1] South Florida refers to the following coastal counties: Pinellas, Hillsboro, Manatee, Sarasota, Charlotte, Lee, Collier, Monroe, Miami-Dade, Broward, Palm Beach, Martin.

dependent on having reliable and accurate information regarding the presence and distribution of seagrass at a project site. Typically, the existing regulatory framework results in one seagrass survey performed during the planning phase of coastal construction projects. The NOAA's National Marine Fisheries Service (NMFS) generally does not support this approach as it does not allow for the capture of temporal or spatial changes that Virnstein et al. (2009) and others have documented as needed for restoration planning (Fonseca et al., 1998). Therefore, it is prudent that surveys be conducted during a timeframe that represents peak biomass, distribution, and other conditions that favor the ability to detect seagrass, such as good water clarity, light, and temperature.

Several peer-reviewed publications refer to seasonality of seagrass or a seagrass growing season for species found in Florida's waters, including *Halophila decipiens*, *Halodule wrightii*[2], *Syringodium filiforme*, and *Thalassia testudinum*. Other seagrass species are also present in Florida waters (*Halophila englemannii, H. johnsonii,* and *Ruppia maritima*[3]). The seasonality concept is not consistently addressed within the regulatory framework that governs reviews of coastal construction activities in Florida. The ramifications of making management decisions that are not based on the best available seagrass data could lead to undocumented and unmitigated impacts or reduced mitigation for impacts to seagrass; in particular to the species that exhibit higher degrees of seasonality and the most widespread distribution. The regulatory community in Florida is generally comprised of the U.S. Army Corps of Engineers; Florida Department of Environmental Protection; Florida Fish and Wildlife Conservation Commission; Water Management Districts of Northwest Florida, Suwannee River, Southwest Florida, South Florida, and St. Johns River; Fish and Wildlife Service, Environmental Protection Agency, NOAA's NMFS, and NOAA's Florida Keys National Marine Sanctuary, in addition to numerous county and local municipality offices.

Part I of this report synthesizes the existing literature on seagrass seasonality and provides justification for a science-based seagrass survey window for coastal construction project planning within Florida. This section also presents the geographic range of the two most seasonally variable species that are often compromised in coastal development plans, *Halophila decipiens* and *Halodule wrightii*. These species have the widest distribution in Florida and exhibit the most potential for seasonal fluctuations. Part II of this report summarizes characters and life history strategies of seagrass.

Future amendments to this report may address seasonality of other seagrass species also present in Florida waters (*Halophila engelmannii* and *Ruppia maritima*). While most literature pertaining to Johnson's seagrass (*Halophila johnsonii*) was not included in the review, we acknowledge that NOAA's NMFS Protected Resources Division recently announced that revisions to the Recommendations for Sampling *Halophila johnsonii* at a Project Site, as provided in Appendix III of the Final Recovery Plan for Johnson's Seagrass (NMFS, 2002), would allow for year round surveys.

Part I: Seagrass Seasonality and a Seagrass Growing Season for Florida

Seasonal changes in temperature and light are the two most common drivers for seagrass production and biomass maxima and minima (Duarte, 1989) in temperate and tropical seagrass meadows (to name only a few: Sand-Jensen, 1975; Ott, 1980; Dennison, 1987; Nelson and Waaland, 1997; Brouns, 1987; van Tussenbroek, 1994, 1995, 1998). Several peer-reviewed publications refer to seasonality of seagrass or a seagrass growing season for *Halophila decipiens* (Bell et al., 2008; Fonseca et al., 2007; Hammerstrom et al., 2006; Hammerstrom and Kenworthy, 2003; Kenworthy, 2000), *Halodule wrightii* (Virnstein, 1982; Kowalski et al., 2009), *Syringodium filiforme* (Short et al., 1993; Fry and Virnstein, 1988; Kenworthy and Schwarzschild, 1998; Fourqurean et al., 2001), and *Thalassia testudinum* (Gras et al., 2003; Chambers et al., 2001; Fourqurean et al., 2001).

[2] Also referred to as *Halodule beaudettei*
[3] For the purposes of this paper *R. maritima* is considered a seagrass

Seasonality of *Halophila decipiens*

Fonseca (1989) acknowledged that *H. decipiens* is present only through a few months of the year. Within the North American and Caribbean distribution of *H. decipiens*, the vegetative structure nearly disappears in the winter months and generally reappears in the spring from a seed bank (Josselyn et al., 1986; Kenworthy et al., 1989; Kenworthy, 2000; Hammerstrom et al., 2006). Kenworthy (2000) describes a growing season of *H. decipiens* from May to October (summer) and the non-growing season as November to April (winter). Similarly, Hammerstrom et al., (2006) describe that *H. decipiens* displays a strong seasonal pattern of growth (June to October) controlled by a combination of light and temperature. They also note that several descriptive studies and many independent observations corroborate the seasonality of seagrass ecosystems. An approximate 6-month period of vegetative expansion is suggested by Fonseca et al., (2007). They assume these plants have peak germination in April or May and grow until September before beginning to exhibit widespread decline. In this paper, they also note that surveys conducted in October indicated that *H. decipiens* was well into its decline.

Established populations of *H. decipiens* seedlings reach their peak biomass in July and August and begin declining in October, and plants are generally not present from November to May (Kenworthy, 2000). *Halophila decipiens* biomass ranges are generally lowest in the fall and winter (Hammerstrom et al., 2006). These are typical cycles in subtropical regions (Kaldy and Dunton, 2000; Fourqurean et al., 2001). Fonseca et al. (2007) refer to peak growing season data collections in June and July. Surveys performed by Fonseca et al. (2007) also indicated a substantial decline in the October *H. decipiens* density. Whereas Hammerstrom et al. (2006) found that virtually all *H. decipiens* shoots die at the end of the growing season and during this same period roots, rhizomes, and blades begin to deteriorate. Unlike other seagrass genera, a perennial, extensive rhizome system does not form in *H. decipiens* and reappearance of beds is from seed banks and perhaps on very rare occasion from over-wintering vegetative fragments (Bell et al., 2008).

Seeds of *H. decipiens* require light to germinate (McMillan, 1988a, b). Seedlings begin occurring in early May (Kenworthy, 2000). Specifically, populations develop from seeds in early summer and continue to expand through early fall (Bell et al., 2008). During the period of active vegetative growth in summer *H. decipiens* flowers and produces abundant fruits and seeds (Kenworthy, 1992). Hammerstrom et al. (2006) notes that *H. decipiens* flowers and fruit were most prevalent during summer sampling (June 1999, August 1999, and July 2000).

Seasonality of *Halodule wrightii*

Virnstein (1982) observed a dormancy period for *Halodule wrightii* from mid-October to early March with little blade standing crop during winter. He estimated that an approximate 7-month growing season (March through October) occurs with a turnover rate of approximately 10 crops per growing season.

Kowalski et al. (2009) showed a seasonal pattern of shoot production, biomass, above/below ground ratios, and leaf length. This work was conducted in areas with similar latitude and thermal regimes as Florida. Highest above-ground biomass values of late summer and fall were the result of rapid late spring and early summer leaf growth that increased leaf area. They noted a distinct seasonal trend in biomass of *H. wrightii* with highest total biomass occurring in August and October and lowest total biomass values in November and February. In addition, they noted highest shoot production in late spring and again in the fall and lowest production during winter months. They further reported areal production as high from spring to summer before winter decline. A significant difference was determined between May (highest values) and February (lowest values) for areal production. However, compared to Caribbean *Halodule* populations, leaf production and biomass production values were generally low.

Seasonality of *Syringodium filiforme*

Kenworthy and Schwarzschild (1998) noted highest growth rates for *S. filiforme* in June and July. Similarly, Short et al. (1993) refer to the height of the growing season for *S. filiforme* to be July. In the fall (September), growth is reduced (Fry and Virnstein, 1988) and biomass declines (Short et al., 1993). Fourqurean et al. (2001) found that peaks in standing crops of *S. filiforme* occurred in July through August.

Seasonality of *Thalassia testudinum*

For *T. testudinum*, the months of May (Gras et al., 2003) and July (Chambers et al., 2001) are referred to as within the growing season. Fourqurean et al. (2001) found seasonal productivity of *T. testudinum* with annual peaks in August and minima in February, whereas areal productivity peaked in July. Seasonal maxima and minima were 60.9 percent above and below mean productivity. Seasonal peaks in standing crop occur in June.

A Seagrass Growing Season for Florida and Recommended Survey Window

In general, within Florida there is a more substantial seasonal signature as you move from south to north. All seagrass species that occur in Florida are near or at the northern limits of their geographic distribution and experience seasonal fluctuations in temperature and light that affect their distribution and abundance. Even perennial beds will show strong fluctuations (Kenworthy, J., personal communication; NOAA NOS, Center for Coastal Fisheries and Habitat Research, Beaufort, NC. March 1, 2010). Based on multiple years of monitoring, Steward et al. (2006) reference a general summer to winter decline in both seagrass transect length and density. Based on 1996 to 2006 summer/winter seagrass monitoring, Virnstein et al. (2007) show a trend in seagrass transect expansion during summer monitoring events. Fourqurean et al. (2001) conclude that the seasonal maxima of seagrass standing crop in South Florida is 32 percent higher than the yearly mean, with annual peaks in seasonal productivity occurring in August and minima in February.

There are several factors that collectively influence the ability to accurately and reliably detect seagrass. These factors include the seasonal abundance (biomass and density) and distribution of seagrass, light availability, and temperature. Because the months of April and May represent the general time for seedling germination, surveys conducted before June 1 have the potential to underestimate the presence and areal extent of *H. decipiens*. We also point out that winter conditions in Florida can result in higher turbidity in estuarine and marine waters which can reduce visibility. Non-ideal sampling conditions can compromise the ability to accurately survey for seagrass, in particular the diminutive species within the genus *Halophila*. Based on the preceding, NMFS Habitat Conservation Division recommends surveys for seagrass in Florida that are within the range of *H. decipiens or Halodule wrightii* should be done between June 1 through September 30. Results from surveys conducted outside this window will require careful evaluation given the likelihood that seagrass distribution or extent is underrepresented.

Range of *H. decipiens*, *H. wrightii*, and other Seagrass Species off the Coasts of Florida

Since *Halophila decipiens* and *Halodule wrightii* are largely present throughout the range of seagrass habitat in Florida, this argues strongly for their consideration as indicator species for seasonality within this region.

Range of *Halophlia decipiens*

Off the Gulf coast of Florida along the west Florida Shelf, *H. decipiens* is documented as far north as the Big Bend Area, between Anclote Key to Ochlocknee Point (Figure 1) (Iverson and Bittaker, 1986). *Halophila decipiens* distribution extends from inshore bays and estuaries in shallow water (less than 2 meters deep) to offshore on the west Florida Shelf to about 30 meters depth (Fonseca et al., 2007). *Halophila decipiens* extends to the south to the Dry Tortugas where it is reported as deep as 30 through

35 meters (Kenworthy, J., personal communication; NOAA NOS, Center for Coastal Fisheries and Habitat Research, Beaufort, NC. March 1, 2010). The northern extent of *H. decipiens* off the Atlantic coast of Florida is approximately 21.5 kilometers north of the Sebastian Inlet (Figure 1) (Virnstein and Hall, 2009). Generally, along the Atlantic coast of Florida *H. decipiens* grows at depths of 0.5 to 4 meters (Fonseca, M. personal communication; NOAA, NOS, Center for Coastal Fisheries and Habitat Research, Beaufort, NC. February 25, 2010).

Range of *Halodule wrightii*

Halodule wrightii exhibits tropical to subtropical distribution (Zieman and Zieman, 1989), with the exception that it is absent off the coasts of Georgia and South Carolina where a combination of freshwater inflows, high turbidity, and large tidal amplitude restricts occurrence of all seagrass species (Thayer et al., 1997). *Halodule wrightii* is present in waters of the Florida Keys and along the Gulf coast of Florida. The northernmost extent of *H. wrightii* off the Atlantic coast of Florida was recorded at the mouth of Pellicer Creek near Faver-Dykes State Park in St. Augustine, Florida (Figure 1) (Virnstein, B., personal communication; Seagrass Ecosystems Analysts, March 3, 2010).

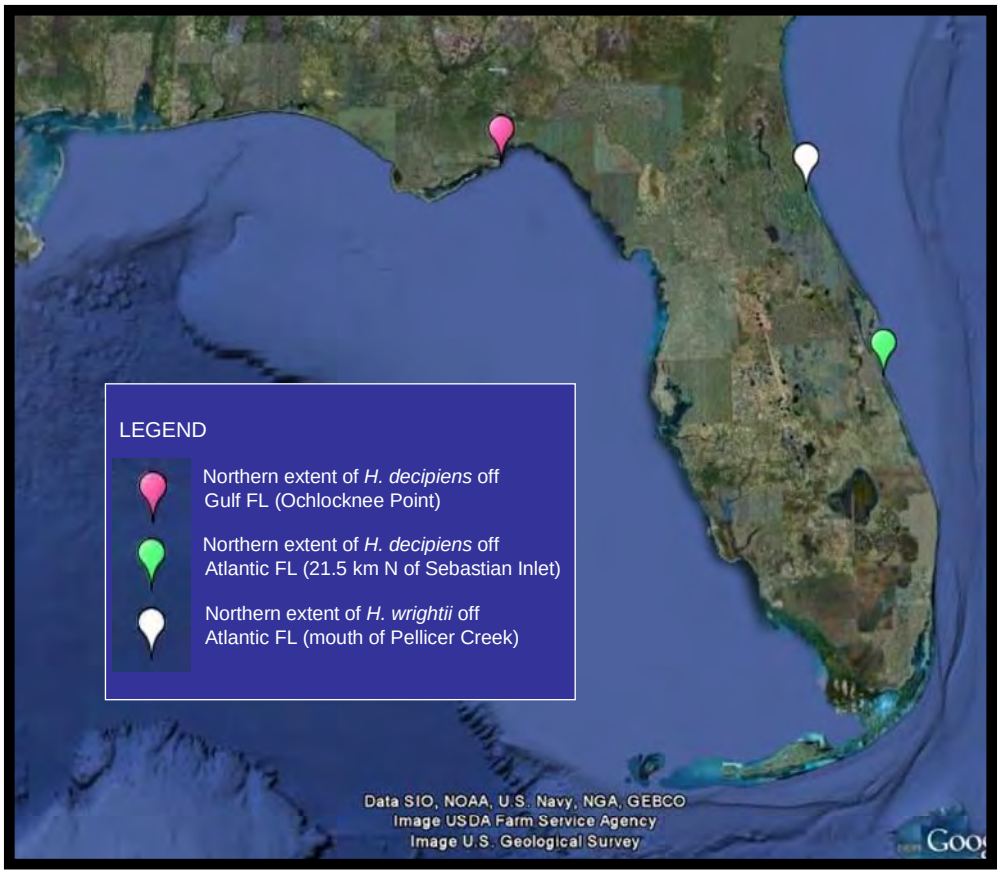

Figure 1: Range limits of *Halophila decipiens* and *Halodule wrightii* off Florida

Range of other seagrass species in Florida

Much less is known about the distribution, abundance, and seasonality of *Halophila engelmannii*. The northern range on the east coast is near Cape Canaveral while on the Gulf coast it occurs as far north as

Florida Bay and in deeper waters of the west Florida shelf up to the Big Bend region. *Ruppia maritima* is an ephemeral, eury-haline species capable of growing in fresh water and hypersaline conditions. *Halophila johnsonii* has the most limited distribution of any seagrass in the world and is located along approximately 200 kilometers of the coastline between Key Biscayne (NMFS 2002) and 21.5 kilometers north of Sebastian Inlet (Virnstein and Hall, 2008). The northern distribution of *T. testudinum* is not as far north as *Halodule wrightii*.

Part II: Characters and Life History Strategies of Seagrass

This report does not synthesize the literature that describes the many services seagrass habitats contribute to marine and estuarine environments (e.g., refuge from predators, sediment stabilization, nutrient cycling). However, a short summary on meadow dynamics for all seagrass species is provided. Since the factors driving the recommended survey window are the seasonality and range of *Halophila decipiens* and *Halodule wrightii*, a few of the unique characters and life history strategies of these species are described.

Seagrass (all species) Bed Dynamics

Regardless of species composition or developmental stage, small seagrass patches and entire beds can move, the rate of which may vary on scales of weeks to decades. It is important to recognize seagrass habitats as including not only continuous vegetated beds, but also patchy environments with unvegetated areas between the patches as part of the habitat (SAFMC, 2009). Available data show that patchy habitats provide many ecological functions similar to continuous meadows (Murphey and Fonseca, 1995; Fonseca, 1996). In addition, it must be recognized that the absence of seagrass in a particular location does not necessarily mean that the location is not viable seagrass habitat and could be considered as potential habitat if the environmental conditions are suitable. It could merely mean that the present conditions are unfavorable for growth, and the duration of this condition could vary from months to years (SAFMC, 2009).

Halophila decipiens and *Halodule wrightii* and the Seed Bank

Many studies suggest *H. decipiens* meadows are annual and rely on seed banks to re-establish and maintain populations (Hammerstrom and Kenworthy, 2003; Hammerstrom et al., 2006), as opposed to a perennial extensive rhizome system found in other Florida seagrass species (Bell et al., 2008). In laboratory settings, *Halophila* spp. seeds can germinate after 1 to 2 years of storage under dark conditions (McMillan, 1988a; McMillan, 1998b; McMillan and Soong, 1989). During the winter, *H. decipiens* seeds are retained in a buried sediment bank avoiding harsh environments present during unfavorable growing conditions (Kenworthy, 2000). A means of surviving unfavorable conditions is to adopt a life history strategy that produces abundant seeds that can remain dormant through a period of light limitation (Kenworthy, 2000). While light levels during winter prevent the growth and expansion of *H. wrightii* and *S. filiforme* into deeper water, the seed reserve allows *H. decipiens* to re-establish seasonal populations where the two larger species cannot exist (Kenworthy, 2000). In the absence of a perennial growth strategy, many *H. decipiens* populations appear to be annual and must reestablish from a seed reserve in the sediment (Hammerstrom et al., 2006). Interestingly, *Halodule wrightii*, is also known to release their seeds near the sediment surface or within the sediments (basicarpy), thus encouraging the formation of seed banks and limiting dispersal (Inglis 2000a, b; Hammerstrom et al., 2006).

Halophlia decipiens Leaf Structure, Light Requirements, Turnover Rates, and Overall Importance

This plant exhibits four characters that support its characterization as a low-light adapted seagrass: 1) thin cell wall which maximizes light absorption by leaves; 2) a low leaf area index to prevent canopy self shading; 3) a lower proportion of non-photosynthetic biomass which minimizes the demand on carbon balance; and 4) a high turnover rate which minimizes the accumulation and shading by epiphytes (Kenworthy, 2000). *Halophila decipiens* lives among the greatest depths reported for marine macrophytes and requires comparatively little light for compensatory photosynthesis (Kenworthy et al., 1987).

Halophila decipiens is characterized by short blades (2 to 3 cm in length) only two cells thick and rapid leaf-pair turnover (days). The roots and rhizomes of *H. decipiens* penetrate only into the top few centimeters of sediment and thus the plants are susceptible to disturbances on the benthos (Bell et al., 2008), e.g., dredging, propeller scarring, and bioturbation. Due to its small size and diminutive structure, *H. decipiens* requires comparatively less light for compensatory photosynthesis; as little as 6 percent of the photosynthetically active radiation that has passed through the air/sea interface (Josselyn et al., 1986) as compared with approximately greater than 20 percent for larger seagrass (Kenworthy and Haunert, 1991; Kenworthy and Fonseca, 1996).

Relative to other seagrass species, the turnover time of *H. decipiens* is high and has been calculated to be 23.3 days for biomass and productivity (Josselyn et al., 1986; Kenworthy et al., 1989). The turnover rate for *H. deicipens* was about 4.3 percent per day, or twice the average for larger seagrass (Duarte and Chiscano, 1999). The leaf modules of *H. decipiens* live less than 30 days (Kenworthy et al., 1989), whereas equivalent modules of *H. wrightii, S. filiforme,* and *T. testudinum* can live for years (Gallegos et al., 1992; Durako, 1994; Kenworthy and Schwarzschild, 1998).

Halophila decipiens provides important contributions to ecosystem primary production in an environment where it substitutes for the larger seagrass that are unable to survive where low light and high rates of disturbance are common (Iverson and Bittaker, 1986). *Halophila* species are recognized for their ability to re-establish populations in environments where salinity and light regularly fluctuate and larger species can not survive (Williams, 1988; Hillman et al., 1995; Kuo and Kirkman, 1992; Longstaff et al., 1999). Although *H. decipiens* is small and present only through a few months of the year, the species provides significant sediment stabilization (Fonseca, 1989) and has been suggested to be a critical link in the food web of the shelf ecosystem (C. Currin, NOAA/CCFHR, unpublished data).

Halophila decipiens and *Halodule wrightii* and Spatial and Temporal Distribution

Halophila decipiens is a highly fecund and cosmopolitan seagrass species, occupying niches which other larger-sized perennial species cannot utilize (Hammerstrom and Kenworthy, 2003). The short life history of *H. decipiens* and the apparent existence of a buried, but moveable seed bank means that spatial organization of this community is dictated by first large-scale dispersal of plant propagules (hundreds of meters) and then within a growing season, by physical perturbation, bioturbation, and clonal organization of the seagrass operating over very small distances (Fonseca et al., 2007). This species can contribute to a more clumped distribution early in the growing season with subsequent vegetative extension. Fonseca et al., (2007) point out that large-scale disturbance events, such as hurricanes, act to redistribute *H. decipiens* propagules, whereupon clonal organization of the plants in their spring to fall existence likely dictates the pattern of seafloor occupation. Furthermore, bioturbation plays an important role in either burying seeds or bringing seeds to the sediment surface where they can germinate. They further note that this species appears to have the facility for resiliency of severe disturbances (e.g., hurricanes) of its community that appear to be able to move the seed bank hundreds, if not thousands of meters, leading to tremendous seasonal changes in the spatial distribution of the plants. The small seed size and the burial of unvegetated substrate by sediments, coupled with movement along with sediment is a plausible mechanism to explain the inter-annual patterns of seagrass distribution (*sensu* Josselyn et al., 1986). Thus, the definition of "seagrass habitat" for this genera can be highly misleading if presently vacant spaces among patches are not properly considered as requisite space for persistence of the community (*sensu* Fonseca et al., 1998). Inglis (2000b) discusses how *H. wrightii* seed banks can move along with migrating sand waves.

Additional Relevant to Mapping, Sampling, and Conserving *Halophila decipiens*

Use of aerial photography or imagery for mapping *H. decipiens* is not recommended. In deeper water (depths greater than 2.0 meters), the signature of the three small, low relief species of *Halophila* is rarely

detected. The distribution and abundance is best determined by direct underwater observations (Kenworthy, 2000). See *NMFS Best Management Practices for Surveying Seagrass for Coastal Construction Planning* (2010) for a list of best management practices for surveying for seagrass for coastal construction planning in Florida.

Trawling [or any bottom disturbing activities] during the growing season could potentially influence the distribution of the seed bank and disrupt colonization in the spring, which could deplete cover in the following growing season. Repeating such bottom disturbing activities may have potential to lead to the elimination of ***H. decipiens*** over large areas, making the community reliant on long distance dispersal of seed stocks to recolonize injured areas (Fonseca, M. personal communication; NOAA, NOS, Center for Coastal Fisheries and Habitat Research, Beaufort, NC. February 25, 2010).

Steward et al. (2006) states that one consequence of human development in a coastal basin is the loss of natural hydrologic buffers (e.g., loss of wetlands and natural drainage features and their flood storage and flow attenuation capacities) that can compromise an estuary's resiliency or capacity to recover from hurricanes. While studies have shown that some seagrass beds were resilient to acute hurricane effects, signs of chronic instability (large variability in coverage and density over the long term) in segments that are continually affected by drainage from upland developments are evident (Steward et al., 2006).

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Guidance on Surveys for Potential Impacts to Submerged Aquatic Vegetation

Office of Resilience and Coastal Protection
Florida Department of Environmental Protection

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1.0 Introduction

1.1 Purpose of Monitoring Guidance

The purpose of this document is to provide guidance on Florida Department of Environmental Protection-approved monitoring protocols to document potential impacts to submerged aquatic vegetation (SAV) that can be used to make the permitting process more efficient, predictable and consistent. Aspects of this document are intended to be scalable and adaptable to work for a wide range of projects statewide. This document is intended to assist those applying for permits issued by the Beaches Inlets and Ports Program (BIPP) in Tallahassee, including Joint Coastal Permits (JCP) and Environmental Resource Permits (ERP). The Submerged Lands and Environmental Resource Coordination program has reviewed this guidance and determined it is generally applicable to ERPs that are issued by district offices, water management districts and other delegated local governments. However, each project is unique and coordination with the department (including BIPP staff, district office staff and aquatic preserve staff, depending upon the project location) is strongly encouraged during the planning phase prior to an applicant's decision to use this guidance document. For example, if *Halophila johnsonii* may be present in the project area, then more intensive sampling may be required by the department (and/or by federal agencies) to be compliant with the South Atlantic Regional Biological Opinion (SARBO; NMFS 2020) and the Final Recovery Plan for Johnson's Seagrass (NMFS 2002).

This document is not currently adopted by rule or statute. Requirements (e.g., protocols, timelines and deliverables) described herein will only become binding on applicants/permittees who choose to accept them as a means of fulfilling regulatory requirements, as monitoring requirements that will be included as specific conditions of permits. Means and methods other than those described herein may be proposed by the applicant and will be subject to review and acceptance by the department under applicable rules and statutes.

1.2 Regulatory Basis for Monitoring

Submerged aquatic vegetation is an economically and ecologically valuable natural resource. In fact, seagrasses are deemed essential to the oceans, gulfs, estuaries and shorelines of the state according to Section 253.04(3)(a) Florida Statutes (F.S.). Therefore, these resources are managed and regulated by the state, including the department (FWC 2003). Construction can negatively impact SAV (Erftemeijer

and Lewis 2006; Short et al. 2017). Direct impacts can occur as a result of removal of SAV via dredging or burial of SAV from filling. Construction can cause physical damage to SAV outside the dredge or fill template (authorized boundaries), including mechanical damage due to equipment or anchoring. Additionally, projects may cause shading, sedimentation and other changes to water quality (e.g., turbidity, salinity or temperature) that could adversely affect SAV.

The department requires reasonable assurance the permitted activities will not adversely affect the habitat of fish, wildlife and listed species, including SAV habitats, pursuant to Section 373.414(1)(a)2, Florida Statutes (F.S.), and Sections 62-330.301(1)(d) and 62-330.302(1)(a)2, *Florida Administrative Code* (F.A.C.), and Section 10.2.2(a) of the ERP Applicant's Handbook Volume 1. Therefore, information on SAV habitats within the potential influence of projects is required to be provided with applications for ERP and JCP projects to provide reasonable assurance the rules and statutes of the department will be met. Information on SAV within the influence of projects can be used to identify and implement practicable measures to avoid or minimize potential impacts to fish and wildlife habitats, pursuant to Section 10.2.1 of the ERP Applicant's Handbook Volume 1 and Subsection 18-21.004(2)(i), F.A.C. If impacts to SAV are unavoidable, then mitigation shall be required to ensure no net loss of functions, pursuant to Section 373.414(1)(b), 18-21(2)(i), F.A.C., and Section 10.3.1 of the ERP Applicant's Handbook Volume 1. If compensatory mitigation is required to offset impacts to SAV, then surveys are required to provide information necessary to implement the Uniform Mitigation Assessment Method (UMAM), Rule 62-345 F.A.C., which describes how the department calculates the amount of compensatory mitigation needed to offset impacts to surface waters, including SAV habitats (pursuant to Section 373.414(18), F.S.). Moreover, the department may require monitoring of SAV habitats as a condition of ERP and JCP permits to document potential unauthorized impacts to resources that may occur as a result of construction activities, pursuant to Section 373.413(1), F.S and Section 62-4.070(3), F.A.C. The department has the authority to issue any permit with specific conditions necessary to provide reasonable assurance that department rules can be met, pursuant to Section 62-4.070(3) F.A.C.

1.3 Submerged Aquatic Vegetation

For the purpose of this document, "submerged aquatic vegetation" is defined as a benthic community comprised of any species of seagrass and/or rhizophytic macroalgae, including both calcareous and non-calcareous taxa. An analogous definition is used by the National Marine Fisheries Service to describe SAV, which is designated as an Essential Fish Habitat (NMFS 1998). Drifting macroalgal mats (drift algae) comprised of filamentous taxa that are ephemeral depositions on the benthos provide ecological

functions (Arroyo and Bonsdorff 2016); however, areas without any seagrass or rhizophytic macroalgae that contain only drift algae are not considered SAV for the purpose of this document.

The distribution of SAV is not static. Seagrass patches migrate and unvegetated areas between patches are important to the management and conservation of these resources (Fonseca et al. 1998). Accordingly, this document defines "SAV habitat" as areas that are currently vegetated by SAV as well as currently unvegetated areas adjacent to SAV that have historically supported SAV and are capable of supporting SAV based on current conditions such as the water environment, sediment characteristics and light availability.

Please be advised, while this document is primarily intended to provide guidance for projects with marine and estuarine SAV, at the department's discretion, this guidance may also be applied to/adapted for use on projects with freshwater SAV resources (e.g., *Vallisneria american*).

2.0 Survey Protocols

2.1 Timing of Surveys

Surveys should be completed during the peak growing season to capture the maximum spatial extent and cover of SAV. This is particularly important in portions of the state where seagrasses senesce over the winter. To be consistent with federal requirements, the department recommends surveys be completed between June 1 and Sept. 30. However, in some circumstances the department may allow surveys to be completed at other times during the growing season. For example, under some circumstances, the department may accept SAV surveys from April to October in most of the state and year-round surveys may be acceptable in Monroe County and southern Dade County. Applicants are strongly encouraged to coordinate with the department prior to initiating field work to schedule joint site inspections; early coordination is especially important if an application will be submitted outside of the growing season; it is imperative department staff have an opportunity to verify site conditions during the growing season.

2.2 Surveys for Planning and Permitting

All SAV resources within the influence of the project should be investigated (identified, mapped and characterized as prescribed in Sections 2.2.1 – 2.2.3) during the project planning and permitting process. A detailed description of the methods used to investigate SAV resources in the project area should be provided along with the information obtained through these efforts in the permit application. The results

of this SAV investigation will be used to evaluate unavoidable impacts, to identify practicable strategies to minimize impacts and to develop appropriate monitoring protocols for documenting potential unauthorized impacts. All SAV resources that may be directly or indirectly impacted by construction activities, including (but not limited to) placement of fill or subsequent equilibration of fill materials, dredging or dredging-related sloughing, shading by permanent or temporary structures, changes in hydrology, project-generated sedimentation, turbidity or other construction-related discharges should be surveyed. The survey should include all SAV resources within or adjacent to the dredge template, fill placement areas, mixing zones, submerged pipeline corridors, dredged material disposal area return water/discharge locations, ingress/egress or staging areas and any other area where project-related impacts are possible. Potential reference sites for comparison with the project area should also be investigated (identified, mapped and characterized as prescribed in Sections 2.2.1 – 2.2.3) during planning, if such sites will be used to evaluate background variability (Section 2.3.4).

2.2.1 Desktop Assessment of Available Information

A desktop assessment (DA) should be completed, during which all relevant information on SAV resources in the project area is compiled and reviewed. For example, historical aerial photography, imagery from unmanned aerial vehicles, side-scan sonar survey data and data from previous field surveys are potential sources of information. However, the apparent absence of SAV in aerial photographs or side-scan sonar should not be used as conclusive evidence that the project area does not contain SAV because some SAV taxa (notably *Halophila spp.*) cannot be detected using such methods. A summary of existing information on SAV in the project area shall be developed based on the results of this investigation and shall be submitted to the department with the permit application. Information obtained from this desktop assessment will be used to identify all potential SAV habitats (Section 1.3) within the project area and will be used to determine the spatial extent of the reconnaissance survey (Section 2.2.2). If information on SAV in the project area is not available or not adequate to identify potential SAV habitats, then the entire area under the influence of the project shall be assessed during the reconnaissance survey.

Any relevant information that is available on physical attributes of the project area should also be compiled and reviewed. Understanding environmental conditions, such as water depth, tidal height, current speed, wave exposure, fetch and flushing, can be useful for assessing the suitability of the project area for SAV as well as evaluating potential impacts of the proposed project on SAV resources; therefore, information on these parameters should be evaluated if available. Existing sources of data

such as bathymetric surveys, geotechnical investigations and water quality monitoring stations should also be reviewed as part of the desktop assessment.

2.2.2 Reconnaissance Survey

A reconnaissance survey (RECON) shall be conducted throughout all potential SAV habitats (Section 1.3) within the influence of the project to identify currently vegetated areas. The results of the desktop assessment should be used to inform this field effort, but the reconnaissance survey will not be limited to only those areas were SAV resources were previously reported. A grid of transects running perpendicular to and parallel with the proposed project boundaries is recommended for this purpose. Reconnaissance surveys may be completed using towed video, only if video is watched in real-time by observers on the vessel to ensure the camera is positioned at the appropriate angle and video is of sufficient quality to identify resources. Alternatively, video surveys may be completed by towed divers. In-water surveys by divers are preferred to video surveys in areas where water clarity is low, if resources are sparse or small in stature (and therefore unlikely to be detected on video); in this case, divers can traverse the area, visually assess resource boundaries and collect representative photos. If the project area is less than 0.25 acres in size, the distance between survey track lines shall be no greater than the visibility at the site at the time of the survey, such that the entire benthos is visually assessed for the presence of SAV. For larger projects, spacing between survey tracks should be minimized to the maximum extent practicable to thoroughly survey the benthos (e.g., transects spaced at 10-meter intervals). The coordinates of the survey track lines shall be reported along with the visibility of the site on the date of the survey. If SAV resources are identified during reconnaissance surveys, these resources shall be mapped and characterized (per Section 2.2.3).

2.2.3 Mapping and Characterization Survey

A mapping and characterization survey (MC) shall be completed, as described below (Sections 2.2.3.1 and 2.2.3.2) to investigate all areas with SAV that were identified during the reconnaissance survey (Section 2.2.2). The purpose of this survey is to provide information on site conditions for planning and permitting. The mapping and characterization survey may be completed by the monitoring firm immediately following the reconnaissance survey, so a separate field effort/remobilization is not required.

2.2.3.1 Mapping

The spatial distribution of SAV within the survey area(s) shall be mapped. The edge of each SAV patch shall be visually assessed by divers *in situ* and divers shall record the position of the edge as accurately as possible. The positioning data shall be recorded and the total acreage of SAV within each patch/bed shall be reported. For projects where SAV is extensive and continuous, it may be sufficient to delineate only the SAV edge that is proximate to the construction template (e.g., fill placement or dredged area). For example, if a continuous SAV bed is located in the nearshore adjacent to a beach nourishment project, then it may only be necessary to delineate the landward edge of the bed. The information obtained from this mapping effort shall be used to produce a georeferenced map showing the distribution of SAV taxa in the project area, which should be included in the permit application.

To ensure map products will be useful for planning and permitting, it is recommended the following mapping criteria be used for creating and submitting SAV map-related deliverables:

- All spatial information should be collected using a sub-meter accurate Differential Global Positioning System (DGPS) unit.
- Geographical information should be provided in the State Plane Coordinate System (SPCS) for Florida (NAD83) and coordinates (latitude and longitude) should be provided in decimal degrees to the fifth decimal place (hundred-thousandths).
- An ArcGIS Map Package (".mpk" file format) or similarly detailed and complete data package (e.g., CAD ".dwg" file format) should be provided with spatial data and metadata.
- SAV areas with different species compositions and/or densities should be distinguished via symbology (e.g., coloration and fill patterns).
- Map figures should include a legend, metric scale bar and north arrow for reference.
- Map figures should be shown at an appropriate scale that allow features to be readily discerned on a standard-size printed page.
- Map figures should be overlaid on recent aerial imagery and should include polygons or lines depicting project boundaries and significant features (e.g., dredge or fill template, footprint of structures).

2.2.3.2 Characterization

An *in-situ* visual assessment shall be completed concurrently with the mapping effort to document the condition of each mapped SAV area. This visual assessment should document the following indicators of function: location and landscape support, water environment and community structure (as defined in

62-345.500 F.A.C.). Site conditions such as sediment type, sediment depth, salinity, water temperature, current speed and flushing should be noted. Water depth shall be measured, corrected for tidal height and reported in metric units. Apparent water quality issues such as harmful algal blooms and signs of eutrophic conditions, such as mats of cyanobacteria, should also be reported. Landscape features, such as other natural communities, shoals and man-made structures, within and adjacent to sites should be described. The proximity of the site to any channels should be noted as well as boat traffic and recreational use in and around the site. Anthropogenic impacts such as the presence of debris, propeller scars or vessel blowouts within and adjacent to sites should be described. Wildlife observed at the site and signs of wildlife, including evidence of bioturbation, should also be reported. A description of site conditions observed during this visual assessment should be provided in the permit application.

Community structure should be qualitatively assessed. The general condition of vegetation such as canopy height, flowering, epiphyte coverage and disease shall be described. SAV communities shall also be quantitatively evaluated within quadrats placed within SAV patches. Randomized placement of quadrats is preferred, but quadrats can be placed haphazardly, if randomization is not practicable. Quadrat placement shall not be biased. However, only vegetated areas shall be surveyed. Quadrats placed within bare areas within the SAV habitat should be noted and repositioned into areas containing SAV. Within each quadrat the cover-abundance (CA) of SAV shall be assessed as prescribed in Section 2.3.6.3. Replicate quadrat samples are necessary to adequately characterize the SAV community. It is recommended that a 1 m^2 (1 m x 1 m) quadrat be used for this survey; if a smaller quadrat is used, then additional quadrats should be sampled. At least 5 m^2 should be sampled in small areas (those less than 0.1 acres). For larger sites, it is generally recommended that at least 1 m^2 be sampled per 80 m^2 of the area to be surveyed, which is a density of approximately 50 (1 m x 1 m) quadrats per acre. A description of the community structure, including the species composition and percent cover of SAV based on quadrat data, shall be provided with the application.

Once SAV resources in the project area have been mapped and characterized, if any unavoidable impacts are expected to occur as a result of the proposed project, the applicant should coordinate with department staff on mitigation requirements. If compensatory mitigation is required, the applicant will need to develop a comprehensive mitigation plan. To facilitate this process, a separate guidance document has been developed for surveys associated with planning and implementing compensatory mitigation projects for SAV (DEP 2020).

2.3 Permit-Required Surveys for Documenting Potential Unauthorized Impacts

The purpose of this section is to provide guidance on monitoring to document potential unauthorized impacts that may occur as a result of permitted construction activities to provide reasonable assurance the project will not adversely affect SAV habitats, pursuant to Section 373.414(1)(a)2, F.S. As previously stated (Section 1.1), the requirements (e.g., protocols, timelines and deliverables) described herein are only binding on permittees who accept them as a means of fulfilling regulatory requirements, as monitoring requirements in a permit.

Generally, minimization measures and monitoring requirements are discussed during the planning phase of project development (pre-application phase) and are finalized in consultation with the department during the permitting process. The monitoring approach (i.e., scope and scale of surveys; Section 2.3.1 and 2.3.2) will depend upon the risk of impacts, which is based on the proximity of resources to construction activities, the type of construction activities, the duration of construction, site-specific conditions such as sediment grain size and local hydrology, as well as the minimization measures that will be employed to reduce potential impacts to SAV resources. For example, in some projects, turbidity curtains are used to contain sediments suspended by the project (or the mixing zone is truncated to exclude resources), a buffer is established around SAV within which no work is allowed and information (e.g., anchoring and spudding positions) is submitted to provide reasonable assurance that minimization measures are properly implemented.

2.3.1 Minimal Monitoring for Projects with Low-Risk of Impacts

Some projects have a relatively low risk of impacting SAV, either due to the nature of the project or because stringent minimization measures will be implemented to provide reasonable assurance that unauthorized impacts to SAV resources will be minimized or avoided. For low-risk projects, survey requirements can be minimized. In such cases, a pre-construction survey (including both a reconnaissance survey along with a mapping and characterization survey, as prescribed in Sections 2.2.2 and 2.2.3, respectively) should be completed. For such projects, an impact assessment (Sections 2.3.3 and 2.3.6.5) would also be required to document the severity and spatial extent of impacts to SAV, if construction-related impacts occur or are suspected to have occurred, so these impacts can be remediated and/or mitigated. If an impact assessment is not needed (Section 2.3.3), then no post-construction survey would be required.

2.3.2 Comprehensive Monitoring to Document Potential Unauthorized Impacts

If project-related impacts to SAV resources are reasonably likely to occur due to the nature of the project or because stringent minimization measures are not practicable, then the department will require comprehensive pre- and post-construction monitoring to document potential unauthorized impacts to SAV resources. The purpose of monitoring is to provide reasonable assurance that the spatial extent and severity of any unauthorized project-related impacts will be documented if they occur, so these impacts can be remediated and/or mitigated. Specifically, monitoring is intended to 1) identify all SAV resources in the project area, 2) map resources to document any changes in their spatial distribution/acreage and 3) quantitatively assess the condition of resources pre- and post-construction to document changes in community structure.

This monitoring approach requires a detailed SAV monitoring plan, which should be developed in coordination with (and approved by) the department before the permit application is determined to be complete. The information provided in this guidance document is intended to form the basis for such monitoring plans; the protocols and requirements described herein can be adapted on a project-specific basis depending upon site conditions and the type of construction activities that are proposed. Early coordination (during the planning/pre-application phase) between the applicant and the department on the monitoring plan is strongly recommended.

2.3.3 Monitoring Events – Survey Schedule

The number and timing of surveys required will depend upon the monitoring approach (Sections 2.3.1 and 2.3.2), the nature of the project and the construction schedule. Each project is unique; therefore, the survey schedule will be determined in coordination with the department during the planning/permitting process. However, all surveys should be completed during the growing season (per Section 2.1), unless otherwise approved in writing by the department prior to the initiation of survey work.

For low-risk projects, a pre-construction survey (i.e., reconnaissance, mapping and characterization; Sections 2.2.2 and 2.2.3) should be completed during the growing season immediately prior to construction. In some cases, the initial reconnaissance, mapping and characterization survey for planning/permitting purposes may be used to fulfil this pre-construction survey requirement. However, if site conditions are likely to have changed since the initial mapping and characterization survey (e.g., due to a major storm event or because the initial survey was completed more than one year prior to construction), then another survey event should be completed prior to construction. Additionally, an

impact assessment survey would be required if construction-related impacts occur or are suspected to have occurred, but if no impacts are suspected to have occurred, then no post-construction monitoring is required. The permittee should coordinate with the department to determine what surveys are needed for low-risk projects.

Projects requiring comprehensive monitoring shall be surveyed at least once before and after construction and an impact assessment would also be required if construction-related impacts occur or are suspected to have occurred. If comprehensive monitoring is required for dredging activities or any other construction activities authorized by ERP or JCP permits, then a pre-construction baseline survey shall be completed prior to construction. If construction occurs during the growing season, then SAV surveys shall be conducted immediately prior to construction and immediately after construction has been completed, within the same growing season. However, if construction occurs outside of the growing season, then monitoring shall be done during the growing season immediately prior to construction and the growing season immediately following construction; in this scenario, the post-construction survey(s) shall be done as close as possible to the same time of year as the pre-construction survey to avoid seasonal differences. In some cases, during construction surveys may be required. If construction continues for more than a year (extends over more than one growing season), then a survey shall be completed each growing season until construction has been completed.

Under some circumstances more than one post-construction survey may be required. An immediate post-construction survey may be required for some projects; for example, a survey must be completed within –one to three months post-construction for projects with *H. johnsonii* to be consistent with SARBO (NMFS 2020). Additionally, if a project is expected to have long-term effects on SAV resources, then additional annual surveys will be required. For example, post-construction monitoring annually for five years is typically required to document potential impacts for projects that are expected to alter the hydrology such that SAV may be adversely affected. For beach nourishment projects, annual surveys are typically completed for two years following the immediate post-construction survey to document potential impacts due to equilibration of fill materials over time; the duration of monitoring will depend upon the details of construction (e.g., density of fill), additional annual monitoring events may be required.

For all projects with SAV, an in-water visual assessment will be required if unauthorized impacts are observed or are likely to have occurred during construction. Events, activities or uses that will require an

impact assessment, including any unauthorized anchoring, storage, staging, discharge, or stockpiling of vessels or equipment within mapped SAV areas; a pipeline leak/rupture within 150 meters of SAV, or any other unauthorized or unanticipated construction-related events, activities, or uses that are suspected to have impacted SAV. The permittee shall complete an assessment of potential impacts to SAV (as prescribed in Section 2.3.6.5) as soon as practicable but no more than 15 days after identifying (or being notified of) the need for an impact assessment, unless a time extension is granted in writing by the department.

2.3.4 Monitoring Area(s)

If comprehensive monitoring is required to document potential unauthorized impacts (Section 2.3.2), then all SAV resources within the influence of the project for which mitigation has not been provided shall be monitored. Monitoring shall include all resources within areas that may be impacted by construction activities, including impacts due to placement of fill (or subsequent equilibration of fill materials), dredging (or dredging-related sloughing), project-generated sedimentation and turbidity and changes in hydrological conditions or water quality. The monitoring area shall include resources within or adjacent to construction areas, including the dredge template, fill placement area(s), mixing zone, submerged pipeline corridor(s), ingress/egress or staging areas and any other portions of the project area where project-related impacts are possible.

Surveys associated with dredge and fill projects are generally restricted to SAV resources within 150 meters of (or within the mixing zone for) the actual portions of the project area that will be affected by the construction event. However, under some circumstances (based on available information, analyses of potential impacts and best-professional judgment), the department may require monitoring to a distance less than or greater than 150 meters from construction activities. At the time of the pre-construction survey, if it is unknown which portions of the project will be constructed, then the entire project area should be monitored prior to construction; however, only those areas potentially influenced by construction activities would need to be surveyed post-construction.

If comprehensive monitoring is required, then a reference site (or sites) should also be surveyed so natural variability in SAV can be compared to potential changes in SAV within the project area. The use of a reference site is particularly important in areas where environmental factors beyond the control of the permittee are likely to influence the condition of resources during the monitoring period. For example, if the area is subject to periodic discharge of storm water, then reference sites are necessary to

distinguish changes in SAV due to project-related impacts from those associated with these discharge events. In such cases, at least one reference site shall be identified for comparison with the project area; however, the use of more than one reference site is recommended, if such sites are available. The reference site(s) should be located as close as possible to the project area without being within the potential influence of construction activities; best professional judgment shall be used to identify reference site(s) similar to the project area with respect to water environment and community structure. The reference site(s), if required, will be surveyed concurrently with surveys in the project area, using the same sampling design and methods used for the project area (Sections 2.3.5 and 2.3.6).

2.3.5 Sampling Design

If comprehensive monitoring is required (Section 2.3.2), then the sampling design for the project should be developed in consultation with the department during the planning and permitting process. The sampling design will be based on the nature of the project and site conditions that were documented during the mapping and characterization survey (Section 2.2.3). The sampling design will typically include the use of quadrat and/or transect-based survey methods. For small projects (e.g., dock or seawall installation or repair projects), it may be practicable to survey the entire area using a grid of quadrats or series of belt transects. In some project areas, quantitative assessments of SAV (Section 2.3.6.3) shall be completed using quadrats that are distributed in a random or stratified-random manner within the survey area(s). For example, the use of randomly placed quadrats is generally considered to be appropriate for large projects where discontinuous and distinct SAV patches are present and when SAV patches are expected to migrate under natural conditions within the landscape over the duration of the monitoring period. This design also may be applied when site conditions, such as very strong currents or very high boat traffic, prohibit the use of transects or in areas with very small SAV patches, where transect-based methods are not necessary to cover a representative proportion of the survey area.

The monitoring for some project areas may include the use of transect-based sampling methods. For example, transect-based methods are appropriate for areas where SAV forms continuous persistent beds and the distribution of SAV is not expected to shift during the monitoring period. Transects are generally established perpendicular to construction activities (e.g., dredge or fill area) to detect a potential gradient of impacts away from construction activities. For example, the use of shore-perpendicular transects is recommended for nourishment projects to detect potential cross-shore movement of materials as they equilibrate following placement in the beach fill template.

If the project is intended to be compliant with SARBO (NMFS 2020), then the sampling design shall be consistent with the "Recommendations for Sampling *Halophila johnsonii* at a Project Site" as provided in Appendix III of the Final Recovery Plan for Johnson's Seagrass (NMFS 2002). For example, if *H. johnsonii* may be present in the project area, then a more intensive sampling design than that specified below will likely be required (e.g., sampling 10%-30% of the project area).

2.3.5.1 Data Collection in Randomly Placed Quadrats

The number of quadrats per SAV patch will depend upon the size and uniformity of the survey area. For this purpose, the applicant should use cover data collected during the characterization surveys (Section 2.2.3.2) to evaluate natural spatial variability in SAV cover at the site(s) and use this information to determine the minimum number of quadrats necessary to detect significant changes in SAV cover (e.g., conduct a power analysis; determine sample size based on the minimal detectable difference). For large projects, it is recommended at least 5% of the area be surveyed (Table 1), if practicable. The corresponding pre- and post-construction surveys shall sample the same number and sizes of quadrats for each patch, even if patch size has declined.

Table 1: Guidance on approximate number of quadrats to be sampled within SAV patches.

Patch size (acres)	Patch size (square meters)	Number of quadrats (1 m x 1 m)
<0.01	< 40	3
0.01 to 0.025	40 - 101	5
0.025 to 0.05	101 - 202	10
0.05 - 0.1	202 - 405	20
0.1 to 0.25	405 - 1012	50
0.25 to 0.5	1012 - 2024	100
0.5 to 1	2024 - 4047	200
> 1 acre	> 4047	300 or 5% of the area, whichever is less.

2.3.5.2 Data Collection Along Transects

The number, spacing and length of transects shall be determined in coordination with the department during permitting, based on the size of the project and distribution of SAV within the influence of authorized construction activities. All transects shall be established perpendicular to construction activities (e.g., dredge or fill area). Generally, it is recommended transects be spaced no more than 50 meters apart near dredging templates, including navigation channels and borrow areas. Cross-shore transects should be placed no more than 75 meters apart for monitoring beach restoration or nourishment projects. Once the positions of transects have been determined, transects shall be marked via the

installation of PVC pipe, sub-surface buoy, or other means, and the starting and ending positions of each transect shall be recorded as accurately as possible using a sub-meter DGPS. Once established, the position of transects shall remain consistent for all subsequent surveys. Markers used to identify transects shall be removed following the completion of the last monitoring event.

For all transects containing SAV, cover-abundance of SAV shall be documented within quadrats at regular intervals along the entire length of each transect. For example, for relatively small beds, quadrats could be positioned every 5 meters along the transects. When sampling larger SAV patches, such as those that extend the entire length of the standard 150-m mixing zone, quadrats shall be placed such that they extend over the entire area of potential impact. In this scenario, it is recommended quadrats be placed at 15 positions: 0, 5, 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, 100, 125, 150 meters along a 150-meter-long transect. Additional quadrats may be required if the mixing zone or area of potential influence extends beyond 150 m. During the pre-construction survey quadrat placement should be adjusted as necessary to maximize the number of quadrats containing SAV while maintaining space between quadrats. Once established, the positions of quadrats along transects should be consistent across surveys.

2.3.6 Monitoring Methods

2.3.6.1 In-situ Delineation of SAV

During the growing season prior to each construction event, a reconnaissance survey (Section 2.2.2) shall be conducted throughout all potential SAV habitats to identify currently vegetated areas that shall be delineated (DE) and surveyed pre- and post-construction to document any potential project-related impacts. During each monitoring event (pre- and post-construction), the edge of each SAV patch shall be delineated *in situ* by divers; divers shall visually assess and record the position of the edge as accurately as possible using a sub-meter accurate DGPS unit. A continuous track-line is preferred, but if this is not possible, then individual data points (waypoints) may be collected (e.g., at 5-meter intervals or major inflection points) to document the position of the edge. For projects where SAV is extensive and continuous, it may be sufficient to delineate only the SAV edge that is proximate to construction activities. Mapping methods should be coordinated with the department during permitting and finalized prior to completion of the monitoring plan and permit application.

2.3.6.2 Visual Assessment of Site Conditions

Site conditions should be visually assessed (VA) and indicators of function such as canopy height, epiphyte coverage, flowering, disease, drift algae, bioturbation, propeller scars, shoaling, water quality, clarity and visibility shall be observed and noted. Density of SAV shall be observed and reported as either sparse (<5% cover), moderate (25-50% cover), or dense (50-100% cover); if density varies within the site(s), this should be described in the reports. Any signs or indicators of potential impacts, such as sloughing, scouring, exposed rhizomes, burial or sediment accumulation shall be reported. A detailed description of the current conditions shall be provided, including a description of any visually conspicuous changes in the condition of resources compared to previous surveys. Representative photographs of each patch (or discrete area) shall be taken to document site conditions. Additionally, water depth shall be measured, corrected for tidal height and reported in metric units.

2.3.6.3 Quantitative Assessment of Cover-Abundance

The cover-abundance of SAV shall be visually assessed within 1 m^2 (1 m x 1 m) quadrats. The department shall be consulted regarding the possible use of smaller sized quadrats (0.25 m^2 or 0.5 m^2); the use of smaller quadrats will typically require additional quadrats to be sampled. Generally, it is recommended that quantitative data be collected within a quadrat that is divided into 100 sub-units or "cells." Cover-abundance (percent cover) of SAV is determined by counting the number of cells with SAV and calculating the percentage of cells within the quadrat with SAV. This method is preferred because it is highly repeatable and interobserver error is typically low. However, the use of subdivided quadrats (cell count method) may not be practicable at sites where long-bladed seagrass taxa are dense. Under certain circumstances, depending upon project-specific logistical constraints and site conditions, the department may accept rapid estimates of SAV cover. For example, the percent cover of SAV may be visually assessed and reported to the nearest 5% or reported using the Braun-Blanquet cover-abundance scores (Table 2). If Braun-Blanquet cover-abundance scores are recorded in the field, then data shall be converted to percent cover using a standard conversion table (Table 2) prior to performing data analysis. Cover-abundance methods shall be discussed during the planning and permitting process. Once cover-abundance methods have been approved by the department, these methods should remain consistent across all surveys and sites.

Drift algae can obscure SAV and dense accumulations of drift algae may smother SAV; therefore, reporting dense accumulations of drift algae is necessary to understand potential factors affecting SAV

resources in the project area. Drift algae within the quadrat shall be recorded in the field notes as sparse, moderate or abundant and then carefully removed prior to visually assessing rooted or anchored SAV taxa (seagrass and rhizophytic macroalgae, respectively). Once drift algae have been removed from the quadrat, the biologist shall assess the total cover-abundance of SAV, which is the total cover of all seagrass and rhizophytic macroalgae taxa. The total cover-abundance of all seagrass species and the total cover-abundance of all rhizophytic macroalgae genera shall also be reported. The biologist shall also report the cover-abundance of each seagrass species and each rhizophytic macroalgae genera present within the quadrat. The results of this assessment should be used to calculate the frequency of occurrence (percentage of all quadrats that contained SAV), the density (average cover-abundance for all quadrats sampled) and the abundance (average cover-abundance for only those quadrats containing SAV). These metrics shall be calculated for 1) all SAV, 2) all seagrass, 3) all rhizophytic macroalgae, 4) each seagrass species and 5) each rhizophytic macroalgae genera.

Table 2. Braun-Blanquet Cover-Abundance Scores and Conversions to Percent Cover.

Score	Description of Cover	Approximation of Percent Cover
0	Absent from quadrat	0
0.1	A solitary shoot, <5% cover	0.02
0.5	Few (<5) shoots, <5% cover	0.1
1	Many (>5) shoots, <5% cover	2.5
2	5 - 25% cover	15
3	25 - 50% cover	37.5
4	50 - 75% cover	62.5
5	75 - 100% cover	87.5

For some projects, the density of seagrass shoots shall be also be recorded and reported as another metric of SAV abundance. For example, if *H. johnsonii* is present (in accordance with SARBO; NMFS 2020) or if the project must be clearly in the public interest because the project is located within an Outstanding Florida Water. Seagrass shoots shall be counted within multiple 0.01 m^2 (10 cm x 10 cm) quadrats and the density of seagrass shoots shall be reported separately for all species present within quadrats.

2.3.6.4 Line Intercept Survey

For projects with a transect-based survey design (Section 2.3.5.2), a line intercept survey (LI) shall be conducted along each transect during each survey event. All transects shall be surveyed to document the linear extent (recorded to the nearest 0.1 m) of SAV present along (directly below) each transect line.

During each line intercept survey, a biologist shall swim the length of each transect and note the location and linear extent along the transect tape of bare substrate, rhizophytic macroalgae and seagrass (reported by species). During this survey, drift algae should be noted in the field observations as sparse, moderate or dense and then carefully removed to ensure no SAV is present underneath. Areas containing only drift algae shall be considered as bare substrate for the purposes of assessing net-cover of SAV. For segments along the transect where SAV taxa overlap, each shall be reported.
Total length of each transect shall be reported along with the percentage of that transect covered by each category of cover, which are defined as follows: 1) seagrass, 2) rhizophytic macroalgae and 3) areas with no SAV (bare substrate and areas containing only drift algae). The line intercept data shall also be used in conjunction with the delineation data (Section 2.3.6.1) to calculate the net-acreage of SAV coverage at each of the sites; net-acreage of SAV = (total acres of site) X (percentage of site covered by SAV). Reports shall include calculations for: 1) net-acreage of seagrass 2) net-acreage of macroalgae and 3) net-acreage of any SAV.

2.3.6.5 Impact Assessment Survey

The purpose of the impact assessment (IA) is to provide the information needed for the department to determine if corrective actions are necessary (such as the remediation of physical impacts or transplanting) and to calculate the amount of compensatory mitigation that may be required to offset unauthorized impacts using UMAM. The impact assessment is a targeted investigation of areas that are known or suspected to have been impacted by construction activities or secondary impacts associated with the project. For example, if the impact assessment is required because of unauthorized anchoring, then all anchoring locations located within mapped SAV areas should be investigated. If an impact assessment is required because a pipeline ruptures during construction, then all SAV areas that may have been affected by the rupture should be investigated. If an impact assessment is required because a construction vessel grounded or caused propeller scaring, then it may be helpful to use the contractor's vessel track-history as a starting point for investigating potential impacts.

The primary objective of the impact assessment is to document any visually conspicuous signs of impacts, such as physical damage to SAV caused by dredging equipment, boat groundings, propeller scars, anchors, scouring, sloughing, sediment accumulation and any other signs of impact. The magnitude of functional loss associated with impacts shall be observed and described. For example, information such as notable reductions in SAV biomass or the thickness of materials that were

accidentally deposited on the benthos should be reported. Representative photographs shall be collected to document the condition of SAV and signs of impacts in each investigated area.

The GPS coordinates for any locations with impacted SAV shall be recorded and reported. The spatial extent of impacts to SAV shall be documented and the acreage of impacts to SAV resources shall be reported. Survey data shall be used to produce a geo-referenced map of all impacted SAV areas, including vegetated areas and unvegetated SAV habitats (Section 1.3); map products should be compliant with the mapping criteria described in Section 2.2.3.1.

3.0 Quality Control/Quality Assurance

Measures shall be taken to ensure the production of high-quality data, which are accurate, complete and consistent. Data should only be collected by qualified biologists, who have cross-trained and completed *in-situ* calibration exercises to reduce interobserver error. The data management process should be well documented and transparent. Consistent methods should be used for all monitoring events to allow temporal comparisons to be made between datasets.

3.1 Qualifications for Biologists

To provide reasonable assurance surveys will accurately document the condition of SAV resources, all surveys should be conducted by qualified biologists with experience performing *in-situ* SAV surveys. The department recommends biologists have at least a Bachelor of Science (a graduate degree is preferable, but not required) from an accredited institution in either marine biology, biology with a concentration in marine sciences, environmental science with a minor in biology or a similar degree. Biologists should also have professional experience and expertise in surveying SAV (preferably for similar construction projects) and a scientific knowledge of SAV. Biologists should have experience collecting data while snorkeling and certification for self-contained underwater breathing apparatus (SCUBA) may be required if site conditions necessitate such equipment. The resumes for all biologists shall be submitted to the department at least 15 days before the initiation of surveys. The department will review this information, verify whether biologists meet the minimum qualifications and will provide written comments regarding any perceived deficits in qualifications or experience.

3.2 *In-situ* Calibration

If more than one biologist is responsible for *in-situ* data collection, then all biologists shall participate in cross-training and calibration activities to verify correct species identification and survey practices.

These Quality Assurance/Quality Control (QA/QC) activities should be completed at the beginning of each monitoring event. The results of these QA/QC activities shall reflect consistency of at least 90% for each SAV cover metric that will be used for the project (e.g., cell-counts, Braun-Blanquet scores and shoot counts); biologists should be able to positively identify all SAV taxa (i.e., 100% agreement on seagrass species and macroalgae genera). Copies of the field sheets used for these QA/QC activities should be submitted with the data deliverables (Section 4.2). If only one biologist will be collecting data for a project, then regular cross-training and calibration with other biologists is recommended but is not required.

3.3 Data Management

During data collection, biologists shall check their field datasheets to ensure completeness, legibility and accuracy. Biologists should initial each sheet after it has been checked in this manner. Once field datasheets are cleaned and dried at the office, data shall be entered into a project-specific Excel spreadsheet. The spreadsheet data shall be checked against the original datasheet (or a photocopy) to ensure data were transferred correctly. Any changes to datasheets shall be made in coordination with the biologist who collected the data; any changes to field sheets shall be done using a colored marker. Datasheets shall be electronically scanned, saved as PDF files and submitted to the department with the data deliverables (Section 4.2).

3.4 Amendment of Survey Protocols

Consistent data collection methods are necessary to evaluate changes in the condition of SAV resources over time. If any amendments to the sampling design or methods are necessary due to field conditions or any other reason, then the permittee and the monitoring firm shall contact resource staff in the permitting office that issued their permit (BIPP, District Office or other delegated permitting authority). Any changes to permitted monitoring requirements shall be coordinated with department staff and the permittee or their monitoring firm must receive written approval from the department prior to the implementation of revised protocols. Such coordination is necessary to ensure revised protocols fulfill the monitoring objectives and provide reasonable assurance to the department. Note: a permit modification may be required to authorize changes to survey protocols.

3.5 Addressing Potential Conflicts of Interest

Permittees who want to remain eligible for potential cost-sharing of monitoring costs for JCP projects must demonstrate there are no potential conflicts of interest or perceptions of such conflicting interests.

Therefore, monitoring data and statistical analysis must be provided directly and concurrently from the monitoring firm to the department, permittee, consultant(s) and local sponsor(s) to comply with the Florida Auditor General report 2014-064 and to be consistent with Section 287.057(17)(a)(1), F.S.

4.0 Notification and Reporting for Permit-Required Surveys

All correspondence related to the submittal of information, data deliverables, or reports for the project should be provided to the department's point-of-contact (POC) specified by the permit. For projects permitted by BIPP, the POC for such correspondence is the JCP Compliance Officer (JCPCompliance@floridadep.gov). All correspondence shall reference the permit number and project name. Additionally, correspondence should reference the number of the specific condition(s) of the permit and/or section(s) of the monitoring plan that requires the submittal of the information provided in each deliverable. Email correspondence is preferable when possible, but some deliverables may need to be submitted using other electronic delivery methods such as a file transfer protocol (FTP) website or delivery of an external hard drive. Regardless of the delivery mechanism, the permittee is responsible for ensuring the department receives all deliverables prior to permit-required deadlines.

4.1 Notification of Survey Initiation/Completion

The department's point of contact (POC) shall be notified via email before the initiation of each survey and provided with an approximate date that survey work will begin. The department's POC shall also be notified (via email within 48 hours) when survey work has been initiated and when each survey has been completed.

4.2 Submittal of Data

Data (field sheets and Excel spreadsheets), ArcView GIS files (including SAV delineations) and representative photographs shall be submitted no later than 45 days after each survey is complete. All data shall be carefully checked (as described in Section 3.0) before submittal. Digital photographs submitted to the department shall be organized (sorted within file folders) by location (e.g., project or reference site; patch, transect and/or quadrat position). Monitoring data and statistical analysis must be provided directly and concurrently from the monitoring firm to the department, permittee, consultants and local sponsors (Section 3.5).

4.3 Map Deliverables

Mapping data collected in the field (track-lines or waypoints) shall be reported along with the total acreage of SAV within each patch/bed during each survey. Pre- and post-construction delineation data shall be used to evaluate changes in the distribution and acreage of SAV over time. The post-construction SAV acreage shall be compared to the pre-construction SAV acreage. The information obtained from mapping efforts shall be used to produce a georeferenced map showing the distribution of SAV taxa in the project area. Map products should be compliant with the mapping criteria described in Section 2.2.3.1.

4.4 Submittal of Reports

4.4.1 Reporting for Projects with Low-Risk of Impacts

For low-risk projects with minimal monitoring, a report describing the results of the pre-construction SAV survey will typically be provided at least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required by the permit (Table 3). This pre-construction report shall include a georeferenced map of SAV boundaries based on the reconnaissance and mapping survey tasks, representative photographs and a description of the current condition of SAV based on the characterization survey. The information in this report shall be used by the permittee and their contractor to implement permit-required minimization measures. Moreover, this report shall also contain information on the pre-construction condition of SAV resources that could be used for UMAM if there are any unauthorized impacts. If an impact assessment is required, then an impact assessment report shall also be submitted (Section 4.7).

4.4.2 Reporting for Comprehensive Monitoring

For projects requiring comprehensive monitoring, the results of the pre-construction survey shall be provided at least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required by the permit (Table 3). A formal pre-construction report is not required, but the pre-construction deliverables shall include a georeferenced map of SAV boundaries based on the reconnaissance and mapping survey tasks, representative photographs, a description of site conditions based on the qualitative assessment and the data for the quantitative assessment of cover-abundance (and line intercept surveys, if required). A post-construction report shall be prepared and submitted to the department within 90 days of the completion of each post-construction survey (Table 3). This report shall include the results for each monitored metric; all data collected shall be reported. The report shall

describe the results of statistical analyses used to evaluate whether the spatial extent (acreage) and/or cover of SAV (as determined by quantitative assessments Section 2.3.6.3 and/or line intercept surveys Section 2.3.6.4) changed significantly between the pre- and post-construction surveys. Summary statistics, including the average and standard deviation, shall be presented. The report shall provide a comparison of pre- and post-construction data for each area (patch and/or transect) and for the entire project area. If monitoring is conducted at a reference site or sites, then the results of reference site surveys shall also be reported and compared with monitoring results for the project area. If an impact assessment is required, then an impact assessment report shall also be submitted (Section 4.7).

4.5 Evaluation of As-built Survey Results and Physical Monitoring Data

To determine if any unauthorized impacts to SAV resources have occurred as a result of construction activities, the permittee shall review the contractor's as-built (AB) survey results to ensure construction was completed in compliance with the specific conditions of the permit and authorized project drawings. If any substantial deviations from the authorized construction activities are identified during review the as-built results, then a detailed description of these deviations shall be provided. For some projects (e.g., channel dredging), the permittee will also need to provide an evaluation of physical monitoring (PM) data to determine if SAV resources were impacted. For example, the locations of any dredged areas that are not compliant with the authorized template shall be reported, including areas where there is evidence of dredging beyond the authorized template or sloughing beyond the authorized side-slopes. For nourishment projects, all beach profile data available at the time the post-construction report (Section 4.4.2) is being prepared should be evaluated to see if patterns in these data correspond to areas where SAV has changed; for example, evidence that the SAV edge shifted or that cover decreased near portions of the project where fill materials were lost or moved offshore.

The results of this evaluation of the as-built survey and physical monitoring data (AB/PM) will be used to determine whether an impact assessment is required for low-risk projects and to aid in the interpretation of post-construction survey results for projects with comprehensive monitoring. Therefore, timely submittal is important. The permit and/or monitoring plan will specify the timeline for providing this deliverable, which will depend upon the physical monitoring schedule. For example, the AB/PM evaluation may be required to be submitted with the post-construction report or 90 days after the completion of the post-construction physical monitoring event, whichever is later.

4.6 Notification of Impacts

If any unauthorized impacts to SAV occur (or are suspected to have occurred) as a result of construction activities authorized by this permit, then the permittee shall notify the department's POC via email as soon as practicable but no later than 24 hours from the time of discovery. This correspondence should include all available information on impacts and/or incident(s) that (may) have caused impacts.

4.7 Submittal of Impact Assessment Report

If an impact assessment is required (Section 2.3.3), the permittee shall submit an impact assessment report within 15 days of the completion of the impact assessment (Table 3), unless a time extension is granted in writing by the department. The impact assessment report shall provide all information necessary for the department to evaluate whether corrective actions are necessary and to calculate the amount of compensatory mitigation that may be required to offset unauthorized impacts using UMAM. The impact assessment report shall include a description and representative photographs of site conditions and SAV in the project area. Any visually conspicuous signs of impacts shall be documented in the report. The GPS coordinates for any locations with impacted SAV shall be reported. A geo-referenced map of impacted SAV areas shall also be provided to illustrate the spatial extent of impacts; map products should be compliant with the mapping criteria described in Section 2.2.3.1. The impact assessment report shall describe the severity of functional losses that were observed (e.g., degradation of community structure) and the acreage of impacts to SAV and SAV habitat (Section 1.3).

4.8 Submittal of Corrective Action Plan

If the permittee notifies the department (or the department notifies the permittee) that unauthorized impacts to SAV have occurred as a result of construction activities, then within 14 days of notification – unless an extension is granted in writing by the department – the permittee shall submit a draft corrective action plan describing actions that will be taken by the permittee to monitor, remediate and/or mitigate the unauthorized impacts. The corrective action plan shall be implemented by the permittee within 30 days of receiving notification the corrective action plan has been approved by the department, unless an extension is granted in writing by the department.

Table 3: Summary of monitoring events, survey tasks (DA: desktop assessment, RECON: reconnaissance, MC: mapping and characterization, DE: delineation, VA: visual assessment of site conditions; LI: line intercept and CA: cover-abundance; AB/PM: evaluation of as-built survey and physical monitoring data, IA: impact assessment) and deliverables that may be required for projects depending upon the monitoring approach.

Monitoring Approach	Monitoring Event	Surveys / Tasks	Deliverables	Timeline
Minimal monitoring for low-risk projects (2.3.1)	Planning (2.2)	DA (2.2.1); RECON (2.2.2); MC (2.2.3)	Permit Application (2.2)	Prior to completing the application
	Pre-construction (2.3.3)	RECON (2.2.2); MC (2.2.3)	Pre-Construction Report (4.4.1)	At least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required
	Evaluation of potential impacts during or post-construction	IA (2.3.3; 2.3.6.5); AB/PM (4.5)	Impact Assessment Report (4.7); AM/PM (4.5)	IA: Within 30 days of completing the Impact Assessment; AB/PM: as required by the permit
Comprehensive monitoring to document potential impacts (2.3.2)	Planning (2.2)	DA (2.2.1); RECON (2.2.2); MC (2.2.3)	Permit Application (2.2) and Monitoring Plan (2.3.2)	Prior to completing the application
	Pre-construction (2.3.3)	DE (2.3.6.1); VA (2.3.6.2); CA (2.3.6.3); LI (2.3.6.4)[1]	Pre-Construction Deliverables (4.4.2)	At least 30 days prior to construction or 15 days prior to the pre-construction conference, if one is required
	Post-construction[2] (2.3.3)	DE (2.3.6.1); VA (2.3.6.2); CA (2.3.6.3); LI (2.3.6.4)[1]; AB/PM (4.5)	Post-Construction Report/Annual Report (4.4.2) AB/PM (4.5)	Post-Construction Report: within 90 days of completing the post-construction survey; AB/PM as required by the permit
	Impact Assessment (2.3.3)	IA (2.3.6.5)	Impact Assessment Report (4.7)	Within 30 days of completing the Impact Assessment

1: Line intercept surveys will be required for projects with a transect-based survey design (Section 2.3.5).

2: Additional surveys shall be required for dredging projects that extend over more than one growing season, substantially alter hydrological conditions and for beach nourishment projects; annual reports shall be submitted if additional surveys are conducted (Section 2.3.3).

5.0 LITERATURE CITED

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Florida Fish and Wildlife Conservation Commission (FWC)
Coral and Octocoral Mitigation Relocation Recommendations

This document "FWC Coral and Octocoral Mitigation Relocation Recommendations" (FWC Recommendations) is specific to coral and octocoral relocation activities that are being conducted statewide for mitigation[1] purposes. This document and referenced documents are living documents and are updated as new information becomes available, or issues that need to be addressed are identified. For this reason, document dates are provided in the lower right-hand corner for reference purposes.

> ***Attention Permit Processors***
> There are 12 (twelve) items identified in text boxes throughout the document for ease of reference that specifically identify issues to be considered for permit issuance, and FWC-recommended permit conditions.

I. Definitions

For purposes of these FWC Recommendations and Attachment 1 "FWC Coral and Octocoral Visual Health Assessment Protocols for Mitigation Relocation Activities" (Health Protocols), a complete list of coral and octocoral terminology definitions is provided in Attachment 2 "Definitions of Coral and Octocoral Terminology".

II. FWC Authorization Required

An FWC Relocation Special Activity License (SAL) is required for all marine species relocation activities statewide, including but not limited to coral and octocoral mitigation relocation activities. Information on the FWC SAL Program and applications are available here: https://myfwc.com/license/saltwater/special-activity-licenses/

An FWC Relocation SAL will not be issued for any project that is not otherwise fully permitted, unless agreed upon by the permitting agencies.

> ***Attention Permit Processors***
> **1. Recommended Permit Condition**:
> A Special Activity License (SAL) must be obtained from the Florida Fish and Wildlife Conservation Commission (FWC) by the entity that is conducting marine organism relocation activities required by this permit.

III. The Importance of "Urban" Corals

A large majority of coastal construction projects along Florida's Coral Reef occur within interior waterways, which are characterized by urbanized coral environments. Urbanized coral environments are becoming more common due to an increasing concentration of coastal human population, economic activity, and associated changes in land-use, coastal modifications, and dredging (Burt 2014; Guest et al. 2016a; Browne et al. 2019; Burt et al. 2019). Corals present in urbanized areas face challenging environmental conditions such as high turbidity and sedimentation, eutrophication, and pollution (Heery et al. 2018; Burt and Bartholomew 2019; Todd et al. 2019; Figueroa-Pico et al. 2020). Even though inhabiting areas with these challenging conditions can be energetically expensive to corals and result in reduced growth rates and survival, urbanized areas are still typically dominated by robust, stress-tolerant corals that are relatively resistant to bleaching and/or are able to recover from stressors (Guest et al. 2016b; Brown et al. 2020).

[1] For purposes of this document, the term "mitigation" is all-encompassing and includes avoidance, minimization, and compensatory mitigation actions. The term "compensatory mitigation" is specific to actions that are intended to offset impacts that are not avoided or minimized.

Furthermore, corals growing on artificial substrates in interior waterways in Miami, FL have been examined by NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML) and were found to have less bleaching, less disease, more resistance to pollutants, and other molecular markers of coral resilience compared to their offshore counterparts, suggesting these corals could be important for coral conservation and restoration because of their ability to survive longer under predicted end-of-century climate change conditions (Rubin et al. 2021).

For all of these reasons, "urban" corals are considered valuable resources as they appear to contribute robust genetic and adaptable populations to Florida's Coral Reef environment.

IV. Mitigation Approach for Relocation

Relocation of corals and octocorals to suitable sites should occur for all coastal construction projects where complete avoidance is not possible. Coral and octocoral relocation activities should be considered as minimization of project impacts and not as compensatory mitigation. Coral and octocoral relocation activities conducted to minimize project impacts can be accommodated in Florida Uniform Mitigation Assessment Method (UMAM), Habitat Equivalency Analysis (HEA), and Resource Equivalency Analysis (REA) mitigation assessment methodologies, and would result in lower amounts of compensatory mitigation required for a project relative to the amount of mitigation that would be required if coral and octocoral relocation was not performed. Compensatory mitigation should be required for all corals and octocorals that may be impacted by project activities and will not be relocated, and for relocated corals that do not meet permit-established relocation performance standards.

Coral and octocoral relocation activities should not occur during times of severe stress (e.g., localized disease outbreak, coral bleaching, extreme water temperatures (cold or hot), significant algal blooms), or from locations being impacted by significant stress events (e.g., dredging activities, storm water run-off), unless there are extreme circumstances that warrant an exception. FWC will support coral and octocoral relocation activities during times of severe stress or from locations being impacted by significant stress events on a case-by-case basis when resource or project impacts are imminent and cumulatively harmful, and when potential benefits outweigh potential risks.

Compensatory Mitigation Considerations

On a case-by-case basis, the FWC will consider and evaluate any request for the relocation of corals from unstable habitats (e.g., rubble) to be used as a compensatory mitigation measure to offset direct effects from a proposed project. Additionally on a case-by-case basis, FWC will consider and evaluate any request for the relocation of corals that are not otherwise required to be relocated by project permits, to be used as a compensatory mitigation measure to offset the loss of indirect effects that are temporary (e.g., temporary reduction in larval output, temporary reduction in settlement). Evaluation of such requests will be based on the amount of credit that is proposed to be provided for such activities and results from other appropriately monitored and documented relocation activities (e.g., literature, monitoring reports).

Technical Assistance

The FWC is available to provide technical expertise to assist with mitigation assessment (e.g., UMAM, HEA, REA), or the development or review of mitigation plans. The FWC would appreciate the ability to provide additional comments on mitigation assessment, mitigation plans or mitigation plan revisions if such information is not currently available and becomes available in the future.

Attention Permit Processors

2. The FWC recommends that any references in permit language to relocation activities should be identified for purposes of minimization (i.e., to minimize resource impacts due to project activities), and not be identified for compensatory mitigation purposes (i.e., to offset impacts due to project activities), unless specific case-by case considerations have been provided for (see above ***Compensatory Mitigation Considerations***).

V. Coral and Octocoral Resource Surveys

Surveys to identify coral and octocoral resources should be conducted prior to permit application, and resource survey summary reports should be submitted with a permit application. If this does not occur, a resource survey for coral and octocoral resources and summary report will need to be requested from the applicant during the application review process as part of a Request for Additional Information (RAI). Resource surveys should be conducted by biologists skilled in marine invertebrate identification, specifically coral assessment and identification to the species level. At a minimum, resource survey reports should include the following information:

1) Amount of project area surveyed. Resource survey reports should specifically identify the percent of the total project area that was surveyed, and why this area was selected for surveying.

2) Methodology used for the survey. It is important to note that methodologies used to survey for seagrass resources are not appropriate to use for surveying for coral and octocoral resources. Survey methodology used to identify coral and octocoral resources should be specifically identified and appropriate for such resources.

   Surveys for ESA-listed coral species and associated Critical Habitat must utilize NOAA Fisheries *ESA-Listed Coral Colony and Acropora Critical Habitat Survey Protocol* located here: https://www.fisheries.noaa.gov/southeast/consultations/regulations-policies-and-guidance

   Surveys conducted for nearshore projects within the boundaries of the Florida Keys National Marine Sanctuary (FKNMS) generally must be permitted and as such, must utilize *Florida Keys National Marine Sanctuary Resource Assessment Survey Protocols for Nearshore Construction Projects*.

   At this time, there are no specific survey methodologies that are recommended for conducting surveys for coral and octocoral resources, but methodologies must be appropriate for the resources (coral, octocoral) and species (ESA-listed) being surveyed, and must adhere to survey protocols for project location (FKNMS), if applicable.

3) A summary of resource survey results. If complete information for all corals and octocorals that are located within the project area is not provided in the survey report by individual species type, numbers, sizes and location (including extrapolations if needed), it may necessitate surveys to be repeated and/or survey reports to be amended.

4) Location information. For ESA-listed species, GPS coordinates of each individual colony should be documented. For species that are not ESA-listed, sufficient location information should be provided so that corals can potentially be located at a later time to facilitate relocation activities. Recommended location information includes GPS location of each survey site (unit = decimal degrees and state datum), along with a description of where each colony occurs (measurement along a transect or location within a quadrant), and a site map with locations of each colony.

   It should be noted that specific coordinates for individual corals are extremely beneficial to facilitate salvage for research or restoration donation activities that may occur prior to, or during, relocation activities.

Resource Survey Purpose

In general, coral and octocoral resource surveys serve several important project-permitting purposes:

- Identification of presence/absence of listed species and associated critical habitat
- Provide resource estimates to evaluate potential project impacts, and to determine appropriate and necessary minimization and compensatory mitigation actions

While coral and octocoral resource survey information serve the above important purposes for the permit application review process, resource survey information should not be used for permit conditions to specifically identify numbers of corals and octocorals by individual species type and sizes that need to be relocated for the following reasons:

- Coral and octocoral resource survey information becomes quickly out-of-date due to factors that generally affect species diversity (i.e., individual species type), abundance (i.e., numbers), and size. These factors include, but are not limited to mortality events (e.g., disease), environmental conditions (e.g., water temperatures, water quality), extreme weather events (e.g., named storms, hurricanes), new recruitment, and growth. The amount of time that passes between completion of a resource survey and when coral and octocoral relocation actually occurs after permit issuance, allows for substantial shifts of individual species type, numbers and sizes of coral and octocoral resources present within a project area to occur. This renders resource survey information inadequate to use for permits conditions to specifically identify coral and octocoral individual species type, numbers and sizes that need to be relocated.

- Many coral and octocoral resource surveys are only conducted for a portion of a project area, which means the data from the surveyed portion of the project must be extrapolated and applied to un-surveyed portions of the project to develop estimates of the individual species type, numbers and sizes of corals and octocorals potentially present within the total project area. These extrapolations are only rough estimates of coral and octocoral numbers and should not be used for permit conditions to identify specific individual species type, numbers and sizes required to be relocated.

- Both misidentification of species and lack of sufficient location information (e.g., coordinates, mapping) often occur with resource surveys, which significantly impacts the ability for a relocation contractor to find specific corals and octocorals that were identified in resource surveys in order for them to be relocated. A resource survey contractor is rarely the same contractor that conducts the actual coral relocation activities, so individual species type, numbers and sizes of corals and octocorals identified by a resource survey contractor many times do not match what the relocation contractor actually sees when they get in the water to conduct the relocation activities after a permit has already been issued. This may necessitate permit amendments or lead to violations of permit conditions if such conditions are dependent on specific individual species type, numbers and sizes of corals and octocorals that need to be relocated based on resource survey information.

- Corals and octocorals may not meet the basic health criteria required in the visual health assessment and as such, would not qualify for relocation. Again, this may necessitate permit amendments or lead to violations of permit conditions if such conditions are dependent on specific individual species type, numbers and sizes of corals and octocorals that need to be relocated based on resource survey information.

- For a number of other reasons (health-related, predation, anthropogenic impacts, etc.), the corals might be dead or just not there anymore when relocation activities occur. Again, this may necessitate permit amendments or lead to violations of permit conditions if such conditions are dependent on specific individual species type, numbers and sizes of corals and octocorals that need to be relocated based on resource survey information.

Attention Permit Processors
3. For all of the reasons identified in the above section and to facilitate permit compliance enforcement, FWC recommends that permitting agencies do not identify specific numbers of corals and octocorals by individual species type and size that need to be relocated, based on resource survey information submitted for permit application purposes. Permits can generally be conditioned to eliminate the need to identify specific numbers by species types and sizes to achieve the purposes of relocation by utilizing the permit conditions identified in **X. Coral Relocation by Species and Size** and **XI. Octocoral Relocation by Species and Size**.

VI. Relocation Plans

Coral and octocoral relocation plans should be submitted with a permit application. If this does not occur, a relocation plan will need to be requested from the applicant during the application review process as part of a Request for Additional Information (RAI). At a minimum, relocation plans should include the following information:

1) General criteria for the selection of corals and octocorals that are proposed to be relocated (e.g., species type, sizes, numbers, susceptibility to SCTLD, potential reef-building contributions). Any corals and octocorals that are intended to be salvaged and donated to qualified entities conducting permitted research or restoration activities should be identified, along with the qualified entity that has committed to taking them. Reminder – for ESA-listed coral species, any salvage and donations must be approved by NOAA Fisheries, Protected Resources Division. Also see **IX. Salvage and Donations**.

2) Relocation methodologies – identify the methodologies that will be used to remove, transport, temporarily hold (if applicable), and reattach corals/octocorals.

   There are a number of current relocation methodologies to successfully remove, relocate and reattach corals and octocorals, and there may be additional successful methodologies developed in the future. As such, the FWC does

   not prefer to specify methodologies for these activities and would instead prefer to review proposed methodologies or assist with development of methodologies.

   It should be noted that many coral relocation contractors have proposed to utilize relocation methodology documents developed by the Florida Keys National Marine Sanctuary (FKNMS)[2] as their complete relocation plan. These documents were developed by FKNMS staff for specific activities and projects within the FKNMS and were not intended to be used for any other purpose. Additionally, these FKNMS documents that specify methodologies do not constitute a complete relocation plan and are not appropriate to be represented as a complete relocation plan for coral and octocoral mitigation relocation activities.

3) Reattachment spacing estimates for the relocation site that minimizes competition and provides for colony growth and tissue re-colonization based on species selected for relocation and their morphology, growth rates, and maximum size.

4) Removal site(s) – provide the following information for the removal site(s):
   a. Site coordinates.
   b. Substrate size and substrate type that corals/octocorals are located on (e.g., walls, boulders, rip rap, natural, artificial, metal, concrete).
   c. Identify presence/absence of Stony Coral Tissue Loss Disease (SCTLD) or other suspect or active disease indicators (review attached Health Protocols for suspect or active disease indicators).
   d. Identify presence/absence of predators/competitors/overgrowth (by species if possible, by genus otherwise) on corals and/or substrate corals are attached to.
   e. Water depth.
   f. Water quality.
   g. Water circulation.
   h. Light availability (PAR level).
   i. Orientation of attachment.
   j. Presence/absence of loose rubble.
   k. Identify if it is a low or high energy environment.

[2] "Final Programmatic Environmental Impact Statement for Coral Restoration in the Florida Keys and Flower Garden Banks National Marine Sanctuaries" - dated July 2010; "FKNMS Coral Rescue and Transplant Protocols" - dated November 2011 or May 2013; "FKNMS Coral Rescue & Relocation Protocols" - dated January 2014.

5) Temporary holding site(s) (also see **VII. Temporary Holding Site Selection**) – if a temporary holding site will be used to cache, stage, or acclimate corals/octocorals prior to reattachment, provide the following information for the temporary holding site(s):
    a. Site coordinates.
    b. Proximity to both the removal and reattachment sites.
    c. Estimated length of time corals/octocorals will be maintained in the temporary holding site.
    d. Water depth.
    e. Identify if it is a low or high energy environment.
    f. Level of sedimentation.
    g. Presence/absence of freshwater input.
    h. Verify that the temporary holding site is conservatively further from expected project-associated direct and indirect impact areas.
    i. Identify how corals/octocorals will be maintained in the temporary holding site (e.g., in containers).
    j. Identify if any structures or systems will be installed to facilitate temporary holding of corals/octocorals, and if use of these structures or systems has been requested for authorization in the appropriate permit applications for this project.

> ***Attention Permit Processors***
> **4.** The installation of any structures or materials to facilitate the temporary holding of corals and octocorals prior to reattachment at the relocation site must be authorized by project permits.

6) Relocation site(s) (also see **VIII. Relocation Site Selection**) – provide the following information for the relocation site(s):
    a. Site coordinates.
    b. Proximity to the removal site.
    c. Identify if there has been historic presence of the species to be relocated at the relocation site within recent decades.
    d. Substrate size and substrate type (e.g., natural substrate, boulder artificial reef) that corals/octocorals will be relocated to.
    e. Identify presence/absence of Stony Coral Tissue Loss Disease (SCTLD) or other suspect or active disease indicators (review attached Health Protocols for suspect or active disease indicators).
    f. Identify presence/absence of predators/competitors/overgrowth (by species if possible, by genus otherwise) on corals and/or substrate corals are proposed to be attached to.
    g. Water depth in relation to the removal site.
    h. Water quality in relation to the removal site.
    i. Water circulation in relation to the removal site.
    j. Light availability (PAR level) in relation to the removal site.
    k. Orientation of reattachment.
    l. Presence/absence of loose rubble.
    m. Identify if it is a low or high energy environment.
    n. Verify that the relocation site is not located within a direct or indirect impact area for any permitted, authorized or reasonably foreseeable marine coastal construction activity (e.g., dock/marina/seawall/rip rap work, dredging, beach nourishment, pipeline or communication cable installations), or within exclusion or buffer areas/zones (e.g., military, aquaculture, resource protection).
    o. Provide information on spatial requirements for the species to be relocated which addresses how the relocation site will provide adequate and appropriate space to allow for: colony growth, tissue re-colonization and plating based on colony size, species growth rates, and maximum size capacity

Technical Assistance

The FWC is available to provide technical expertise to assist with the development or review of relocation plans, including relocation methodologies. The FWC would appreciate the ability to provide additional comments on relocation plans or relocation plan revisions if such information is not available at this time and becomes available in the future.

Staff of the Florida Department of Environmental Protection – Coral Reef Conservation Program, NOAA National Marine Fisheries Service, and NOAA Florida Keys National Marine Sanctuary (for projects located within Monroe County) are also available to provide technical expertise to assist with the review or development of relocation plans based on lessons learned on the Florida Reef Tract (FRT). Appropriate contacts for each of these agencies respective programs can be provided upon request.

Attention Permit Processors

5. The FWC does not recommended referencing and attaching relocations plans submitted by an applicant. If relocation plans absolutely must be referenced by and attached to a permit, please include the following Recommended Permit Condition:

Recommended Permit Condition: If there are any conflicts between the Relocation Plan referenced by and attached to this permit, and the terms and conditions of this permit, the terms and conditions of this permit shall be controlling.

Instead of referencing and attaching relocation plans, the following information is what is needed from a relocation plan to include in permit conditions:

a. Identification of what corals need to be relocated. Permits can generally be conditioned by utilizing the FWC recommended permit conditions identified in **X. Coral Relocation by Species and Size** (2 permit conditions – species categories by size and fragmented coral reconstruction) and **XI. Octocoral Relocation by Species and Size**.
b. Removal site coordinates (i.e., project site coordinates).
c. Temporary holding site coordinates if a temporary holding site has been identified, and if requested, authorization for the installation of any structures/materials to facilitate the temporary holding of corals and octocorals prior to reattachment.
d. Relocation (reattachment) site coordinates
e. Relocation methodology

V1I. Temporary Holding Site Selection

If corals and octocorals will be placed within a temporary holding site after removal and prior to reattachment at the relocation site (for caching, staging, acclimation), the FWC recommends the following criteria be adhered to:

1) The temporary holding site for corals and octocorals must be located in a stable area (e.g., low energy, low sedimentation, minimal freshwater input), and err conservatively on the side of being slightly farther from expected project-associated direct and indirect impact areas.
2) Corals must be maintained in a temporary holding site either by affixing them to an elevated structure or placing them in a suspended container in a manner wherein they are above the sea floor and do not touch each other. If corals are to remain in the temporary holding site for longer than two weeks, they must be cemented or epoxied to an elevated structure or to substrate elevated above the sea floor.
3) Octocorals must be maintained in a temporary holding site either by affixing them to an elevated structure or placing them in a suspended bag in a manner wherein they are above the sea floor and have adequate water flow (i.e., bags should not be crowded). If octocorals are to remain in the temporary holding site for longer than two

weeks, they must be attached with zip ties by their holdfast or base to an elevated array or line system previously installed on the sea floor. Orientation is less important, but octocorals must not touch each other while in holding.

4) The installation of any structure or system to facilitate the temporary holding of corals and octocorals prior to reattachment must be authorized by project permits.

VIII. Relocation Site Selection

The FWC recommends that the selection of an appropriate relocation site(s) for both corals and octocorals meet the following general criteria:

1) The relocation site must be as close in proximity to the removal site as possible to preserve the functional ecosystem value of the surrounding areas provided by the resources to be relocated, but err conservatively on the side of being slightly farther from expected project-associated direct and indirect impact areas.
2) Relocation site must be of suitable reef habitat, be within the known range of the species or genera, and have historic presence of the species to be relocated (in recent decades).
3) Optimally, the relocation site should be located in similar water depths and have similar physical conditions (e.g., light availability, water flow) to those at the removal site.
4) Optimally, the relocation site should have similar substrate orientation to removal site; i.e., if corals or octocorals are being removed from a vertical or sloped elevated surface, then the relocation site should have similar vertical or sloped areas for relocation. It is recognized that this will not always be possible like in situations where corals and octocorals are relocated from vertical surfaces, and in these cases selecting a relocation site that meets all other relocation site criteria is acceptable.
5) Relocation site must not contain large amounts of loose rubble and should not be located in a high energy environment (Edwards and Clark 1998).
6) Relocation site must not be located within a direct or indirect impact area for any permitted, authorized or reasonably foreseeable marine coastal construction activity (e.g., dock/marina/seawall/rip rap work, dredging, beach nourishment, pipeline or communication cable installations), or within exclusion or buffer areas/zones (e.g., military, aquaculture, resource protection).
7) Relocation site must have adequate and appropriate space to minimize competition and allow for colony growth and tissue re-colonization based on species morphology, growth rates, and maximum size.

IX. Salvage and Donations

The FWC supports salvage and donations of corals and octocorals to qualified entities conducting authorized research and restoration activities. The FWC SAL program can facilitate identification of entities that are qualified to receive salvaged corals and octocorals, and inquiries can be made by sending a request for assistance to SAL@MyFWC.com.

The FWC encourages permit applicants to coordinate salvage and donation activities with qualified entities and incorporate activities associated with coral salvage and donations to qualified entities into both their relocation plan and

(sub)contracts with coral relocation contractors. It is the permit applicant's responsibility to ensure that qualified entities have sufficient time to consider everything they need to consider before making a decision as to whether or not they can accept any corals, and should be provided with as much advance notification of coral and octocoral availability to be able to do the following:

1) Consider their projects and whether or not they need any of the species/sizes/condition of the corals/octocorals that are available. If the project does not have corals/octocorals available that an entity needs, they will not commit to taking them. Qualified entities are under no obligation to take any corals or octocorals from any project.
2) Consider if they have space to hold the corals/octocorals once collected, and the resources to support their care for as long as they need to hold them before they are utilized for the activities they are intended to be used for. This might require moving animals around from tank to tank or nursery practitioner to nursery practitioner to make space, along with staffing and budgets to support these activities.

3) If the qualified entities have to collect the corals/octocorals themselves, they will need to consider if they have the staff, equipment and budget to do these activities and are able to mobilize everything within the time frame that is provided to them.
4) If the qualified entities are just accepting the corals/octocorals, they have to consider if they have the space, time, staffing, etc. to be able to accept the corals within the time frame that is provided to them.

> ***Attention Permit Processors***
> **6.** The FWC encourages permit processors to automatically provide for coral and octocoral salvage and donation activities within permit conditions to facilitate research and restoration activities, and to avoid the need for future permit amendments. Any salvage and donations of ESA-listed species must be approved by NOAA Fisheries, Protected Resources Division. The FWC recommended permit conditions identified in **X. Coral Relocation by Species and Size** and **XI. Octocoral Relocation by Species and Size** do provide for salvage and donation activities.

X. Coral Relocation by Species and Size

Relocation is a necessary action for the diversity of coral species impacted by a project, not just the collective number of corals impacted by a project considered as a single group of "corals". Selecting coral species for relocation solely based on ESA-listing and/or an arbitrary minimum size (e.g., 10 cm) eliminates consideration of species diversity and population contribution potential for impact minimization or compensatory mitigation actions.

Coral Species

The FWC has categorized all coral species found on the Florida Reef Tract into three different size classes for relocation activities (i.e., relocate at any size, relocate at ≥ 5 cm, relocate at ≥ 10 cm). The species included within each of these groups were not prioritized, but were categorized based on individual species susceptibility to Stony Coral Tissue Loss Disease (SCTLD) and conservation value (e.g., ESA-listing status, abundance, growth rate and maximum size, contributions to reef-building, genetic diversity, recruitment rate, post-settlement mortality). These size groupings alone cannot be used as a de facto priority list, but the species notes provided can be used to inform prioritization of species in consideration of diversity needs for projects with large number of corals that need to be prioritized for relocation.

Coral Size

FWC focuses on the potential population contributions of a coral based on its reproductive capability, which is dependent on the amount of live tissue – not the overall size of a coral which would also include dead tissue. An arbitrary minimum size (e.g., 10 cm) does not consider live tissue vs. dead tissue, and does not prioritize reproductively capable corals over corals that do not have enough live tissue to reproduce. A 10 cm coral with 2 cm of live tissue and 8 cm of dead tissue is not as valuable as an 8 cm coral with 5 cm of live tissue and 3 cm of dead tissue. As such, FWC recommends that coral "size" is measured as live tissue diameter and not any other method of measurement.

Coral Fragmentation Upon Removal

The potential exists for corals to fragment upon removal. The potential for coral fragmentation upon removal is absolutely not a reason to disqualify corals for relocation. It is feasible for all fragments of the same broken coral to be kept together and reconstructed by reattaching fragments as close together as possible (like puzzle pieces – reattached within 0 - 5 cm apart from one another), to promote successful fusing. Re-constructed corals should be considered as one single coral for monitoring purposes. Research has shown that fragments of the same genet are known to readily and successfully fuse (Raymundo and Maypa 2004). Intentionally fragmenting corals and outplanting the fragments close together to promote fusion is a common practice in coral restoration to increase coral size within a shorter time frame.

Coral Species Relocation Categories by Size

The FWC recommends relocation of all corals at the specified size or larger as identified in the following size categories (adjusted as necessary for project location based on direction in blue), unless donated to qualified entities conducting permitted coral research or restoration activities.

Relocate at any size:

1) *Acropora cervicornis* – ESA-listed; confirmed not susceptible to SCTLD; major reef-building species
2) *Acropora palmata* – ESA-listed; confirmed not susceptible to SCTLD; functionally extinct; major reef-building species
3) Order *Antipitharia* (black corals) – rare
4) *Cladocora arbuscula* (areas on the FRT) – confirmed not susceptible to SCTLD; rare and small; rarely reaches 5-10 cm
5) *Colpophyllia natans* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas; major reef-building species
6) *Dendrogyra cylindrus* – ESA-listed; SCTLD-susceptible; functionally extinct
7) *Dichocoenia stokesii* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas
8) *Diploria labyrinthiformis* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas; reef-building species
9) *Eusmilia fastigiata* – SCTLD-susceptible; significantly impacted by SCTLD
10) **Favia fragum* – unknown SCTLD susceptibility; functionally extinct; small; rarely reaches 5-10 cm
11) *Meandrina meandrites* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas
12) *Millepora complanata* – not susceptible to SCTLD; functionally extinct; reef-building fire coral
13) *Mycetophyllia ferox* – ESA-listed; SCTLD-susceptible; functionally extinct
14) *Orbicella annularis* – ESA-listed; SCTLD-susceptible; major reef-building species
15) *Orbicella faveolata* – ESA-listed; SCTLD-susceptible; major reef-building species
16) *Orbicella franksi* – ESA-listed; SCTLD-susceptible; major reef-building species
17) *Phyllangia* spp. – unknown SCTLD susceptibility; small; rarely reaches 5-10 cm
18) *Pseudodiploria strigosa* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas; reef-building species
19) *Scolymia* spp. – unknown SCTLD susceptibility; cryptic; small; rarely reaches 5-10 cm

Relocate at ≥ 5 cm, measured as live tissue diameter - continuous live tissue patch with a diameter of 5 cm or greater:

1) *Agaricia agaricites* – unknown SCTLD susceptibility; sensitive to temperature/light stress, cryptic, rarely reaches 10 cm
2) *Agaricia fragilis* – unknown SCTLD susceptibility; sensitive to temperature/light stress, cryptic, rarely reaches 10 cm
3) *Agaricia lamarcki* – unknown SCTLD susceptibility; rare; low recruitment; often found > 60'; sensitive to temperature/light stress; relocation size may be increased to ≥ 10 cm for Tortugas and Pulley Ridge areas
4) *Helioseris cucullata* –assumed SCTLD-susceptible (based on susceptibility of family members); rare in FL; low recruitment; often found in deep water or shallower in cryptic locations
5) *Isophyllia sinuosa* – assumed SCTLD-susceptible (based on susceptibility of family members); rare in FL; low recruitment
6) *Isophyllia rigida* – assumed SCTLD-susceptible (based on susceptibility of family members); rare in FL; low recruitment
7) *Madracis auretenra* – assumed SCTLD susceptibility; uncommon to rare; declining trends in counts and live tissue area in long-term monitoring assessments; low recruitment; sensitive to temperature/light stress
8) *Madracis decactis* – assumed SCTLD-susceptible (based on susceptibility of congener); low recruitment
9) *Madracis formosa* – assumed SCTLD-susceptible (based on susceptibility of congener); low recruitment
10) *Manicina areolata* – assumed SCTLD-susceptible (based on susceptibility of family members)

11) *Montastraea cavernosa* – SCTLD-susceptible; significantly impacted by SCTLD; showing signs of recruitment within early SCTLD-endemic areas; major reef-building species
12) *Mussa angulosa* – SCTLD-susceptible; significantly impacted by SCTLD; rare; low recruitment
13) *Mycetophyllia aliciae* – SCTLD-susceptible; significantly impacted by SCTLD; rare; low recruitment
14) *Mycetophyllia lamarckiana* – SCTLD-susceptible; significantly impacted by SCTLD; uncommon to rare; declining trends in counts and live tissue area in long-term monitoring assessments; low recruitment
15) *Pseudodiploria clivosa* – SCTLD-susceptible; significantly impacted by SCTLD; reef-building species; declining trends in counts and live tissue area in long-term monitoring assessments; low recruitment
16) **Siderastrea radians* – often smaller than 10 cm; abundant recruiter
17) *Solenastrea bournoni* – SCTLD-susceptible; significantly impacted by SCTLD; declining trends in counts and live tissue area in long-term monitoring assessments
18) *Solenastrea hyades* – assumed SCTLD-susceptible (based on susceptibility of congener)
19) *Stephanocoenia intersepta* (Monroe County only) – SCTLD-susceptible; reef-building species; abundant recruiter

Relocate at ≥ 10 cm, measured as live tissue diameter - continuous live tissue patch with a diameter of 10 cm or greater:
1) *Cladocora arbuscula* (areas outside of the FRT) – confirmed not susceptible to SCTLD
2) *Oculina diffusa* – unknown SCTLD susceptibility
3) *Oculina robusta* – unknown SCTLD susceptibility
4) **Porites astreoides* – confirmed not susceptible to SCTLD
5) **Porites divaricata* – confirmed not susceptible to SCTLD
6) **Porites furcata* – confirmed not susceptible to SCTLD
7) **Porites porites* – confirmed not susceptible to SCTLD
8) **Siderastrea siderea* – SCTLD-susceptible; susceptible to many coral diseases; reef-building species; abundant recruiter
9) *Stephanocoenia intersepta* (FRT areas outside of Monroe County) – SCTLD-susceptible; reef-building species; abundant recruiter
10) *All species of corals that are not otherwise specifically identified

*If numbers of the species *in red font exceed 50 colonies at the recommended relocation size or larger, the numbers required for relocation are reduced to 50 colonies or 25% of the total number of colonies, whichever is greater (50 colonies minimum). Reduced numbers of colonies must be selected and prioritized for relocation according to the following criteria:

- Colonies of this species should be removed from locations as spread out as possible across the total project area to increase the probability of capturing greater genetic diversity.
- Prioritize corals of larger sizes over corals of smaller sizes.
- Prioritize colonies exhibiting fewer stress indicators.

Attention Permit Processors
7. Recommended Permit Condition (adjusted as necessary for project location based on direction in blue):
All corals located within the authorized project area that measure at or above the specified size category they are classified in below, must be relocated prior to the start of project construction, unless they are of a species for which an expressed exception has been made to decrease numbers that must be relocated or are being donated to a qualified entity conducting permitted coral research or restoration activities.

Coral Species that must be Relocated at Any Size:

1) *Acropora cervicornis*
2) *Acropora palmata*
3) Order *Antipitharia*
4) *Cladocora arbuscula* (areas on the FRT)
5) *Colpophyllia natans*
6) *Dendrogyra cylindrus*

7) *Dichocoenia stokesii*
8) *Diploria labyrinthiformis*
9) *Eusmilia fastigiata*
10) **Favia fragum*
11) *Meandrina meandrites*
12) *Millepora complanata*
13) *Mycetophyllia ferox*
14) *Orbicella annularis*
15) *Orbicella faveolata*
16) *Orbicella franksi*
17) *Phyllangia* spp
18) *Pseudodiploria strigosa*
19) *Scolymia* spp.

Coral Species that must be Relocated at ≥ 5 cm, measured as live tissue diameter - continuous live tissue patch with a diameter of 5 cm or greater:

1) *Agaricia agaricites*
2) *Agaricia fragilis*
3) *Agaricia lamarcki* – relocation size may be increased to ≥ 10 cm for Tortugas and Pulley Ridge areas
4) *Helioseris cucullata*
5) *Isophyllia sinuosa*
6) *Isophyllia rigida*
7) *Madracis auretenra*
8) *Madracis decactis*
9) *Madracis formosa*
10) *Manicina areolata*
11) *Montastraea cavernosa*
12) *Mussa angulosa*
13) *Mycetophyllia aliciae*
14) *Mycetophyllia lamarckiana*
15) *Pseudodiploria clivosa*
16) **Siderastrea radians*
17) *Solenastrea bournoni*
18) *Solenastrea hyades*
19) *Stephanocoenia intersepta* (Monroe County only)

Coral Species that must be Relocated at ≥ 10 cm, measured as live tissue diameter - continuous live tissue patch with a diameter of 10 cm or greater:

1) *Cladocora arbuscula* (areas outside of the FRT)
2) *Oculina diffusa*
3) *Oculina robusta*
4) **Porites astreoides*
5) **Porites divaricata*
6) **Porites furcata*
7) **Porites porites*
8) **Siderastrea siderea*
9) *Stephanocoenia intersepta* (FRT areas outside of Monroe County)
10) *All species of coral that are not otherwise specifically identified

*Exception: If numbers of the species identified *in red font in any of the above size categories exceed 50 colonies at the recommended relocation size or larger, the numbers required for relocation are reduced to 50 colonies or 25% of the total number of colonies located within the authorized project area, whichever is greater (50 colonies minimum). Reduced numbers of colonies must be selected and prioritized for relocation according to the following criteria:

- Colonies of this species should be removed from locations as spread out as possible across the total project area to increase the probability of capturing greater genetic diversity.
- Prioritize larger corals of this species over smaller corals.
- Prioritize colonies of this species exhibiting fewer stress indicators.

Should corals fragment upon removal, all fragments of the same broken coral must be kept together and reconstructed by reattaching fragments as close together as possible (like puzzle pieces – reattached within 0 - 5 cm apart from one another). The re-constructed corals should be considered as one single coral for monitoring purposes.

XI. Octocoral Relocation by Species and Size

The FWC supports octocoral salvage and donations to qualified entities conducting research and restoration activities. The FWC encourages permit applicants to incorporate activities associated with octocoral salvage and donations to qualified entities into both their relocation plan and (sub)contracts with octocoral relocation contractors. The FWC also encourages permit processors to provide for these activities in permit conditions. The FWC SAL program can facilitate identification of entities that are qualified to receive salvaged octocorals, and inquiries can be made by sending a request for assistance to SAL@MyFWC.com.

The FWC recommends relocation of all *Gorgonia* species and other octocoral species ≥ 10 cm in height, unless donated to a qualified entity conducting permitted research or restoration activities. In the event that all octocoral species ≥ 10 cm in height will not be relocated, the FWC has prioritized octocoral species for relocation. Octocoral species have also been prioritized based on a high conservation value (i.e., state prohibited species, conservation need, local abundance/density, growth rates, relocation success, and ability to recover naturally). In general, more robust rod species are slow growing and have low recruitment, but transplant well and seem to recover quickly from being transplanted (e.g., growing a new holdfast over attachment material) (Brinkhuis 2009). Plumes are low on the list because they recruit very quickly after a disturbance and have high growth rates so their potential for natural recovery is greater. Additionally, more delicate plume species have less tissue (e.g., thinner tissue = less potential/resources for healing after clipping) and are inferior transplantation candidates. However, plumes can be transplanted successfully (Brinkhuis 2009).

The prioritized list is as follows:

1) *Antillogorgia*
2) *Eunicea*
3) *Gorgonia* (state prohibited species)
4) *Leptogorgia*
5) *Muricea*
6) *Muriceopsis*
7) *Plexaura*
8) *Plexaurella*
9) *Pseudoplexaura*
10) *Pterogorgia*

In addition to the species previously listed, the following are priority genera if deeper relocation sites are targeted (>60 ft. or >18 m):

1) *Diodogorgia*
2) *Ellisella*
3) *Iciligorgia*
4) *Swiftia*
5) *Telesto*

> ***Attention Permit Processors***
> **8. Recommended Permit Condition** (not prioritized): All octocoral species (including prohibited *Gorgonia* spp.) measuring 10 cm or greater in height must be relocated, unless donated to a qualified entity conducting permitted research or restoration activities.

XII. Visual Health Assessment

To minimize the risk of disease/predators/competitors being spread from the removal site to a temporary holding or relocation site, the FWC recommends a visual health assessment of each coral or octocoral slated for relocation be conducted immediately prior to removal from the project site, and again prior to removal from a temporary holding site (if one is used), pursuant to the attached "FWC Coral [and/or Octocoral] Visual Health Assessment Protocols for Mitigation Relocation Activities" (Health Protocols). Corals and octocorals that do not meet the visual health assessment criteria should not be removed, held temporarily, or relocated.

Exceptions:

- As identified in **IV. Mitigation Approach for Relocation**, there may be circumstances in which the FWC will support coral and octocoral relocation during times of severe or significant stress events. For corals and octocorals that will be relocated during times of severe stress or from locations being impacted by significant stress events, FWC can provide an exception on a case-by-case basis from certain "stress indicators" criterion identified in the Health Protocols. If such an exception is provided by the FWC, these corals and octocorals may be relocated provided that all other criterion in the Health Protocols are met.
- "Urban" corals and octocorals surviving in interior waterways have demonstrated resilience in spite of the poor environmental conditions they are growing in and as such, have strong survival capabilities (potentially genetic) that are highly valued. Corals and octocorals that will be relocated from interior waterways are provided with an automatic exception from the "stress indicators" criterion in the Health Protocols and may be relocated provided that all other criterion identified in the Health Protocols are met.

Corals and octocorals held in a temporary holding site should again be visually assessed for health pursuant to the Health Protocols immediately prior to removal from the temporary holding site and reattachment at the relocation site.

Exception **- The visual health assessment does not need to be conducted for corals and octocorals that have been maintained in a temporary holding site for 48 hours or less.** Any corals or octocorals displaying signs of disease in the temporary holding site should either be: a) removed and disposed of; or b) removed and donated for ex-situ research.

Any corals or octocorals that were selected for relocation but were not relocated because they failed the visual health assessment should be documented in the applicable data sheets provided for reporting requirements (e.g., "3. Non-ESA Diseased Colony Info", "6. ESA Diseased Colony Info").

Attention Permit Processors
9. Recommended Permit Condition:
Corals [and/or octocorals] must be visually assessed for disease immediately prior to removal from the removal site (and again from a temporary holding site if one is used), pursuant to "FWC Coral [and/or Octocoral] Visual Health Assessment Protocols for Mitigation Relocation Activities" (Health Protocols). The permittee or the contractor conducting relocations on behalf of the permittee must follow the most updated version of the Health Protocols when relocation activities occur, as required by an FWC Special Activity License. All corals [and/or octocorals] that meet the criteria established in the Health Protocols must be relocated, and corals [and/or octocorals] that do not meet the criteria cannot be relocated. Field personnel conducting coral [and/or octocoral] visual health assessments must be proficient with species identification and trained in coral [and/or octocoral] disease, predator/competitor identification and removal, and survey techniques to assure accuracy of the assessment.

XIII. Relocation Monitoring and Reporting

The FWC recommends corals and octocorals that are relocated specifically for mitigation purposes are monitored for overall survival and attachment success. This includes baseline data collection conducted at the time of relocation, and subsequent monitoring events at one week (may be conducted at any time during the seven days beginning the day immediately after the day relocation has concluded), at one month, at three months, at six months, and at one-year post-relocation. A two-year monitoring event is recommended as optional. The FWC emphasizes the need for all recommended monitoring events during the first year post-relocation to be performed to support identification of potential causes for coral relocation mitigation failure and/or the potential need for adaptive management measures. The recommended activities to be conducted for each of the recommended monitoring events is provided in Attachment 3 "Coral [and/or Octocoral] Mitigation Relocation Monitoring Requirements." Data sheets and data sheet directions are also provided to facilitate capturing the data requested for monitoring and reporting purposes.

Monitoring Data to be Collected

The monitoring data requested to be collected for coral and octocoral mitigation relocation monitoring activities are specific to determining overall survival and attachment success, thus determining achievement of performance standards for mitigation actions (i.e., mitigation success). The data requested to be collected for monitoring activities will also assist with determining potential factors that may have contributed to the inability for mitigation actions to achieve performance standards (i.e., mitigation failure), such as localized disease or bleaching events, severe storm events, relocation contractor performance, etc. It is recommended that relocation contractors select an appropriate reference site(s) for comparison purposes to assist with determining potential factors that may have contributed to the inability for mitigation actions to achieve performance standards.

Numbers of Corals/Octocorals to be Monitored

If the total quantity of corals or octocorals (considered separately for monitoring purposes) to be relocated comprises less than 4,000 colonies – select a representative subset of relocated corals/octocorals to be used for monitoring events, comprising 25% (or 1,000 corals/octocorals maximum) of the total number of corals/octocorals relocated. This subset must be representative of the species composition and size classes of the total relocated corals/octocorals, with no less than 10 corals/octocorals of each species monitored. If less than 10 corals/octocorals are relocated from a species, all relocated corals/octocorals of that species must be included in the subset. It is possible that for smaller-scale relocation projects, one or both of these requirements will result in all of the relocated corals/octocorals (i.e., set) needing to be monitored.

If the total quantity of coral/octocorals to be relocated exceeds 4,000 colonies, the FWC will reach a consensus with the applicant and the permitting agency on the number of representative subset corals/octocorals that will be monitored (the minimum will be 1,000 corals/octocorals).

Reporting Schedule

Baseline data collected at relocation and data collected during each subsequent monitoring event should be submitted according to the following schedule:

- At relocation (baseline) + one-week monitoring event: Submit location map(s), representative photograph(s), and all applicable data sheets with applicable data recorded, prior to initiating the one-month monitoring event or within 21 days post one-week event, whichever occurs first.
- One-month monitoring event through one-year (or two-year if conducted) monitoring events: Submit representative photograph(s) and all applicable data sheets with applicable data recorded, within 30 days post-event.

Technical Assistance

The FWC is available to provide technical expertise to assist with the development or review of monitoring plans. The FWC would appreciate the ability to provide additional comments on monitoring plans or monitoring plan revisions if such information is not available at this time and becomes available in the future.

Attention Permit Processors

10. Recommended Permit Condition:

Baseline data collection and monitoring must be conducted pursuant to the attached "FWC Coral [and/or Octocoral] Mitigation Relocation Monitoring Requirements". Baseline data collection must occur at the time of relocation, and subsequent monitoring events must be conducted at one week (may be conducted at any time during the seven days beginning the day immediately after the day relocation has concluded), one month, three months, six months, and one year. Baseline data collected at the time of relocation and data collected during each subsequent monitoring event must be recorded in the Excel data sheets provided with no modifications made to the data sheets, and submitted in Excel format (not converted to pdf or any other format), according to the following schedule:

- At relocation (baseline) + one-week monitoring event: Submit location map(s), representative photograph(s), and all applicable data sheets with applicable data recorded, prior to initiating the one-month monitoring event or within 21 days post one-week event, whichever occurs first.
- One-month monitoring event through one-year (or two-year if conducted) monitoring events: Submit representative photograph(s) and all applicable data sheets with applicable data recorded, within 30 days post-event.

Monitoring of relocated corals [and/or octocorals] may be conducted with monitoring subsets. Monitoring subsets must be comprised of 25% (or 1,000 corals [and/or octocorals] maximum) of the total number of corals [and/or octocorals] relocated. These subsets must also be representative of the species composition and size classes of the total relocated corals [and/or octocorals], with no less than 10 corals [and/or octocorals] of each individual species monitored. If less than 10 corals [and/or octocorals] are relocated from an individual species, all relocated corals [and/or octocorals] of that species must be included in the monitoring subsets. These same monitoring subsets must be used for all monitoring events.

XIV. Performance Standards

The performance standard to determine mitigation success for coral relocation activities should be between 65-85% overall survival, with secure substrate attachment, one year after relocation. Overall survival of corals shall be defined as no net loss in pooled (by species) Live Tissue Area Index or an increase in pooled (by species) Live Tissue Area Index.

Live Tissue Area Index is calculated by averaging the coral maximum diameter and coral maximum height, then squaring the average dimension to determine Skeletal Area, then multiplying by the percent live tissue; formula as follows: ((D+H)/2)^2*%L (Williams and Miller 2012). All of the metrics needed to determine Live Tissue Area Index are either requested for collection during monitoring activities (e.g., max diameter, max height, percent live tissue), or are auto populated in the "2. Non-ESA RelocatedColony Info" data sheet provided (e.g., coral skeletal area). The "Coral Live Tissue Area Index" column in the data sheet will also auto-populate once the needed metrics are recorded.

To calculate pooled Live Tissue Area Index by species for purposes of identifying the overall survival percentage, sum the Live Tissue Area Indices by species (not individual coral) that was auto populated for each coral colony that was monitored, and record in the "1. Non-ESA Relocations Summary" data sheet as instructed by the data sheet directions included in the attached "Coral Mitigation Relocation Monitoring Requirements".

Coral Species that are ESA-Listed

There may be additional or separate performance standards to determine mitigation success for coral relocation activities for ESA-listed species as prescribed by the federal Biological Opinion or federal permits for the project.

Octocorals

In order to establish mitigation performance standards for octocorals, FWC recommends evaluating overall survival of relocated octocorals via maximum height, and this metric is requested for collection in "XIII. Relocation Monitoring and Reporting" above. Overall survival shall be defined as no change in maximum height or an increase in maximum height.

The performance standard to determine mitigation success for octocoral relocation activities should be proposed by the applicant and supported by available and appropriate documentation of octocoral relocation activities (e.g., literature, monitoring reports.) FWC request to review these proposals as they are submitted to determine if the documentation submitted supports the performance standard as proposed. **Note** – there is not a data sheet to summarize monitoring information for octocorals as the performance standard has not yet been determined. An additional data sheet will need to be developed to accommodate for summarizing octocoral monitoring information to assist with determining mitigation success.

Technical Assistance

The FWC is available to provide technical expertise to assist with the development or review of performance standards if the recommended performance standards are not incorporated into permits. The FWC would appreciate the ability to provide additional comments on performance standards or performance standard revisions if such information is not available at this time and becomes available in the future.

XV. Adaptive Management

For purposes of these FWC Recommendations, Adaptive Management is defined as a flexible decision-making process employed to address unanticipated events that affect the ability to achieve specified objectives.

In keeping with this definition, Adaptive Management Measures for coral and octocoral mitigation relocation activities are actions that are employed to address unanticipated events (e.g., predation on relocated corals by parrotfish, vessel anchor damage on a relocation site), that may affect the ability to achieve established mitigation performance standards.

Attention Permit Processors

11. The FWC does not recommend specific permit condition language with regards to Adaptive Management, but recommends that a condition is included in the permit that would provide for Adaptive Management Measures to be developed and agreed upon in coordination with the Permittee and permitting/consulting agencies to address unanticipated events that may affect the ability for the Permittee to achieve established mitigation performance standards. This permit condition should also provide advanced authorization to quickly execute agreed upon Adaptive Management Measures without the need to amend permits.

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Florida Fish and Wildlife Conservation Commission (FWC)
Coral Visual Health Assessment Protocols
for Mitigation Relocation Activities

For purposes of these Florida Fish and Wildlife Conservation Commission (FWC), Coral Visual Health Assessment Protocols for Mitigation Relocation Activities (Health Protocols), a complete list of coral terminology definitions is provided in the attached "Definitions of Coral Terminology".

Mitigation relocation activities require certification of health as a condition of authorization. The Health Certification process is conducted by authorized personnel and consists of a visual health assessment pursuant to the criteria outlined in these Protocols.

The visual health assessment must be conducted for each coral pursuant to the criteria in these Protocols to ensure that all corals appear to be in good health, are free from suspected disease and conditions that may impact their health, and that the presence of predators/competitors/overgrowth has been minimized. The visual health assessment must be conducted immediately prior to harvest (i.e., removal) from any in-water location, and may need to be conducted again before the relocation activity is completed (i.e., immediately prior to removal, and again immediately prior to removal from any and all temporary holding locations established to facilitate the relocation activity).

Corals that do not meet the visual health assessment criteria cannot be removed and relocated to other in-water locations. If any part of a coral does not meet all of the criteria for the visual health assessment process, no part of the coral may be removed and relocated even if the affected areas of the coral are removed so that the remaining part of the coral does meet the visual health assessment criteria.

Corals that are located in any temporary holding location and do not pass the visual health assessment criteria must be removed and appropriately disposed of on land.

Field personnel conducting coral visual health assessments should be proficient with species identification, and trained in survey techniques, coral condition assessment, coral disease, and predator/competitor/overgrowth identification and removal, to assure accuracy of the assessment.

Detached Corals

Relocated corals that become detached from the substrate they were attached to must be visually assessed for health before reattaching them back to their substrate. Visually assessing coral health becomes increasingly subjective when a relocated coral is found lying on the sea floor. If there is any doubt that observed abnormalities or conditions may be attributed to active or suspect disease rather than from lying on the sea floor, do not reattach the detached coral, dispose of it on land, and record the disposition in data sheets 3. Non-ESA Diseased Colony Info or 6. ESA Diseased Colony Info.

Coral Visual Health Assessment Criteria

Each coral must be evaluated and meet the following visual health assessment criteria prior to removal from any site and relocation:

1) Each coral harvested for relocation may not show any visible signs of active or suspect disease based on the presence of:

    a. Stress indicators such as: bleaching, partial bleaching, paling, tissue sloughing (caused by sedimentation), swelling or thinning, and excessive mucous production.

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- **Exception**: Exception to these "stress indicators" criterion is automatically provided for corals that are being relocated from interior waterways as identified in the FWC Mitigation Relocation Recommendations, "XII. Visual Health Assessment" section, unless observed abnormalities or conditions may be attributed to active or suspect disease.

  ***Note 1**: Relocation of corals from interior waterways with tissue appearing pale to partially bleached (< 100% of coral tissue) is acceptable as color loss is recognized as a part of coral species' normal state when growing in interior waterways.

  ***Note 2**: Relocation of corals from interior waterways with tissue appearing pink or purple (e.g., *Siderastrea, Madracis, Porites* spp.) as a bleaching response, but not in association with active lesions, tissue damage, or any other visible signs of active or suspect disease, is acceptable as such pigmentation is associated with non-pathogenic bacterial/microbial communities.

b. Recent mortality greater than 5% tissue loss exposing underlying skeleton not due to predation/competition/overgrowth, and recent mortality greater than 10% tissue loss exposing underlying skeleton due to predation/competition/overgrowth.

   - **Exception**: Old mortality is acceptable for corals that will be relocated.

c. Active disease such as: rapid tissue loss, tissue sloughing (not caused by sedimentation), stony coral tissue loss disease (SCTLD), white/black/yellow/red band diseases, white pox or plague diseases, white Beggiatoa mats, dark (purple) spot/blotch diseases, and growth anomalies.

d. Suspect disease indicators such as bands, spots, lesions, and microbial mat colonization.

   - **Exception**: Corals with pale spots or lesions associated with farming damselfish may be relocated.

2) Predators such as fireworms (*Hermodice carunculata*) or snails (e.g., *Coralliophila* spp.) must be removed (e.g., peeled off) prior to relocation.

3) Competitors and overgrowth (e.g., sponges, tunicates, ascidians, octocorals, zoanthids, corallimorphs, macroalgae, cyanobacteria) on any substrate around the base of the coral and on old mortality must be removed (e.g., peeled, scrubbed using wire or plastic brushes, tweezed) as much as possible prior to relocation. If during the process of removing these organisms the removal results in Recent Mortality greater than 10%, then the coral should not be relocated (pursuant to 1.b. above). Corals that have non-native, encrusting and/or overgrowing species on them (e.g., Genus *Symplegma*, Genus *Botryllus*) that cannot be removed may not be relocated.

   - **Exception**: Corals containing boring sponges of the Genus Cliona (e.g., *Cliona deletrix*) are generally discouraged for relocation, but relocation will be expected if the presence of boring Cliona spp. is small (e.g., occupies 10% or less of the surface of the colony), and/or the benefits of relocation outweigh the risks of introducing or increasing prevalence of boring Cliona spp. on corals and substrate at a relocation site. The need for the relocation of corals containing boring Cliona spp. is project-specific and should be discussed in advance of permitting relocation activities or any relocation activities occurring.

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- **Exception**: Corals with established algal lawns created by farming damselfishes may be relocated, provided algal lawns do not cover more than 10% of the surface of the colony.

- **Exception**: Corals containing stramenopile protists that are often confused with competition and overgrowth and appear as white aggregate coatings on the coral surface or embedded in the mucus layer, may be relocated.

FWC Definitions of Coral Terminology

"Bleaching" is the loss of color within coral tissue due to the loss or reduction in number of endosymbiotic algae (e.g., zooxanthellae; Genus *Symbiodinium*). During bleaching, tissue is present but is pale to clear in color, and the white skeleton is visible underneath. A coral may be "bleached" where 100% of tissue is affected by loss of zooxanthellae, "partially bleached" where < 100% of tissue is affected by loss of zooxanthellae and a portion of the tissue remains a healthy color, or "pale" where tissues have not completely lost all zooxanthellae and appear lighter in color especially compared to other corals of the same species.

"Cache" is an in-water temporary holding location to facilitate relocation and transfer activities.

"Coral" is an organism of any life stage or any part thereof, that meets a regulatory definition of "coral" for the Florida Fish and Wildlife Conservation Commission, the Florida Department of Environmental Protection, National Marine Fisheries Service (NOAA Fisheries) as it pertains to the Southeast Region, the Florida Keys National Marine Sanctuary, or the National Park Service as it pertains to National Park areas within Florida.

"ESA-listed species" are species that are listed pursuant to the federal Endangered Species Act.

"Interior waterway" is an aquatic area that has experienced physical restructuring of the shoreline (e.g., inner port harbors, marinas, seawalls), or a naturally occurring area of low flushing (e.g., shallow bays).

"Introduction" is the intentional or unintentional release of a coral into an area and/or habitat in which it is not known to have naturally existed.

"Mitigation" is an action that is taken to avoid, minimize or offset potential negative effects from an activity.

"Nursery" is a land or water-based location where authorized coral holding, propagation, grow out (rearing), acclimation or staging activities occur.

"Old mortality" is the non-living portion of exposed coral skeleton that has been overgrown by algae and other biofouling organisms, and where the corallite structure has eroded over time and may not be identifiable to the species level.

"Outplanting" is removing a coral from an authorized land-based temporary holding location or in-water or land-based coral nursery, and placing such coral into any in-water location outside of an authorized land-based temporary holding location or in-water or land-based coral nursery.

"Recent mortality" is the non-living portion of recently exposed coral skeleton (i.e., skeleton is white and corallite structures are intact and identifiable), including the development of fine "fuzz" or limited turf algae on exposed skeleton (i.e., skeleton is yellowish in appearance and corallite structure may be slightly eroded but still identifiable to species level), indicating that the mortality occurred within a couple of days to weeks prior to observation.

"Release" is the introduction, outplanting, placement, reintroduction, relocation, stocking, transfer, translocation, or transplantation of any coral into or within any in-water location.

"Relocation" is any movement of a coral at any life stage from any in-water location to another in-water location, without utilizing a land-based temporary holding location. Relocation includes translocation and transplantation, but excludes outplanting and transfer. Relocation occurs between a "removal site" (the in-

water site where a coral was harvested from), and a "relocation site" (the in-water location to which the coral is physically moved to), and may potentially include an in-water cache site (an in-water location where corals are temporarily held after removal to facilitate relocation-associated activities).

"Translocation" is the in-water movement of a coral from an area of suitable habitat to another area of suitable habitat, with or without consideration of historic distribution.

"Transplantation" is the in-water movement of coral from one place to another.

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The following are coral mitigation relocation monitoring and reporting requirements and directions for filling out six (6) associated monitoring data sheets. Additional monitoring events and additional data collection may be conducted as needed by the license holder to address individual project documentation needs.

A representative subset of relocated corals must be identified and monitored for each relocation site, and this same subset must be used for all required monitoring events. The monitoring subset(s) must be comprised of 25% (or 1,000 corals maximum) of the total number of corals relocated for the project as a whole. This subset must also be representative of the species composition and size classes of the total relocated corals, with no less than 10 corals of each species monitored. If less than 10 corals are relocated from a species, all relocated corals of that species must be included in the monitoring subset.

Baseline data collection must occur prior to and at the time of coral removal and relocation, and subsequent monitoring events must be conducted at one week, one month, three months, six months, and one year post relocation for each site. Baseline data collected at the time of relocation and data collected during each subsequent monitoring event must be recorded in the six (6) Excel data sheets provided with no modifications made to the data sheets except data sheets may be renamed to reflect the relocation site identifier (e.g., RS1), but the data sheet number must remain in the data sheet new name (e.g., 1. RS1 Summary, 2. RS1 Non-ESA, 3. RS1 Non-ESA Diseased 4. RS1 ESA Sites, 5. RS1 ESA, 6. RS1 ESA Diseased). These data sheets must be submitted for Reporting Requirements in Excel format (not converted to pdf or any other format), according to the following schedule:

- At relocation (baseline) + one-week monitoring event: Submit location map(s), representative photograph(s), and all applicable data sheets with applicable data recorded, prior to initiating the one-month monitoring event or within 21 days post one-week event, whichever occurs first.
- One-month monitoring event through one-year monitoring events: Submit representative photograph(s) and all applicable data sheets with applicable data recorded, within 30 days post-event.

Prior to Relocation:

- Review all permits issued by all agencies (and the Biological Opinion if applicable), and determine which format(s) the removal, temporary holding, and relocation site coordinates need to be provided in for all reporting requirements. For ESA-listed species, the Biological Opinion will typically require single-point coordinates.
- Review the "1. Non-ESA Coral Summary" and "4. ESA Site Descriptions" data sheets and "Guideline A" on page 20 to be familiar with the format options for how to record site coordinates in both of these data sheets. Please note that the site coordinates may need to be recorded in more than one format to meet multiple agency permit-required reporting requirements.

At Time of Relocation:

- Take site coordinates as determined prior to relocation to meet all permit-required reporting requirements. This information will be transferred to "1. Non-ESA Coral Summary" and "4. ESA Site Descriptions" data sheets.
- Individually tag or location mark/tag and map the set or subset of relocated corals to be monitored (including assignment of an identification number or alphanumeric character for each coral), so that they can be tracked individually over time for monitoring events. Location marking and tagging for mapping purposes must include a sufficient number of markers/tags to be able to identify the locations of each relocated coral (e.g., corner point markers, central marker, tagging

each row). Maps that are developed for monitoring purposes must be submitted to meet Reporting Requirements.

- Take a representative photograph (or more than one photograph if necessary) of the set or subset of relocated corals to be monitored, from directly above, which includes a scale bar. These representative photographs must be submitted to meet Reporting Requirements.
- Document any corals that were identified as viable candidates for relocation but were not relocated because they failed the visual health assessment. This information will be recorded in the "3. Non-ESA Diseased Colony Info" and "6. ESA Diseased Colony Info" data sheets.

During All Monitoring Events

- The same set or subset of corals that were tagged and photographed must be used for all of the monitoring events.
- All loose or detached colonies (whether in monitoring subset or not) must be reaffixed to their structure or substrate. If a colony is within the monitoring subset, document the attachment status in data sheets appropriately.
- Take a representative photograph (or more than one photograph if necessary) of the set or subset of relocated corals that are being monitored, from directly above, which includes a scale bar. Representative photographs that are taken for monitoring purposes must be submitted to meet Reporting Requirements.

Recording Data

Each cell in all data sheets must have information recorded in it, **OR A VALUE OF ZERO**. Do not include any symbols (e.g., %), or measurements (e.g., m, cm, ft, kts), unless specified in directions (e.g., 0-20, <1, 5+).

List of Data Sheets

***Note – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1. - 3. for non-ESA listed corals, and 4. - 6. for ESA-listed corals, for each relocation site).**

- **1. Non-ESA Relocations Summary** – this data sheet is for summarizing the monitoring information for all non-ESA listed coral species from data sheet 2., providing information on the removal, temporary holding, and relocation sites, and for baseline and each monitoring event.
- **2. Non-ESA RelocatedColony Info** – this data sheet is where baseline data and data from all of the subsequent monitoring events is recorded for relocated non-ESA listed coral species.
- **3. Non-ESA Diseased Colony Info** - this data sheet is for providing information on non-ESA listed corals that did not pass the visual health assessment at the removal or temporary holding sites and were not relocated, or became detached at the relocation site and were not reattached because they did not pass the visual health assessment.
- **4. ESA Site Descriptions** – this data sheet is for providing the information on the removal, temporary holding, and relocation sites for ESA-listed species only. Since ESA-listed species are evaluated individually, summarized monitoring information is not necessary for these species.
- **5. ESA Relocated Colony Info** - this data sheet is where baseline data and data from all of the subsequent monitoring events is recorded for relocated ESA listed coral species.
- **6. ESA Diseased Colony Info** – this data sheet is for providing information on ESA-listed corals that did not pass the visual health assessment at the removal or temporary holding sites and were not relocated, or became detached at the relocation site and were not reattached because they did not pass the visual health assessment.

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1. Non-ESA Listed Coral Summary Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "1. Non-ESA Relocations Summary" data sheet, record the following information for non-ESA listed coral species PER SPECIES GROUP (not individual colonies), PER RELOCATION SITE:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

A. Provide the Relocation Site Identifier (e.g., name, #, character) as identified in Column BD.
B. Coral Species Name – record each relocated species type by relocation site on a separate row.
C. Total Number of Colonies Relocated – record the total number of colonies for each species type that was relocated by relocation site on a separate row.
D. Total Number of Colonies to be Monitored – record either the total number of individual colonies for each species that will be monitored by relocation site, or the total number of individual colonies for each species that will comprise the "Subset" of colonies to be monitored, by relocation site.
E. Date Relocation Started – this is the date that relocation activities began.
F. Time Remained in Temporary Holding Site – provide the length of time (in # of days) that the corals were held in a temporary holding site before relocation was completed. Record a value of zero if not applicable.
G. Date Relocation Completed – this is the date that relocation activities were completed.
H. At Relocation Baseline (Pooled Coral Live Tissue Area Index) – "sum" the Live Tissue Area Indices auto-calculated for all coral colonies by species type (using column "N" in the "2. Non-ESA RelocatedColony Info" data sheet). The sum can be calculated by using the sum function in Excel using the data range in column R for each pooled species for each relocation site as identified in Column B. The sum function is (=sum(Rstart:R#end)) where the range of data to sum is in column R starting with first row of a relocated colony and ending with the last row of a relocated colony for a pooled species. The species should be sorted to facilitate this. For example, if data for one species are located in rows 6-20 and data for another species are in rows 21-35, the formula would be "=sum(R6:R20)" for the first species and "=sum(R21:R35)" for the second species.
I. 6 Month Monitoring (Pooled Coral Live Tissue Area Index) – "sum" the Live Tissue Area Indices auto-calculated for each coral colony by species type (column "BC" in the "2. Non-ESA RelocatedColony Info" data sheet). The sum can be calculated by using the sum function (=sum(BC#start:BC#end)) in Excel – record the summed amount for each species type identified in Column B. for each relocation site.
J. 1 Year Monitoring (Pooled Coral Live Tissue Area Index) – "sum" the Live Tissue Area Indices auto-calculated for each coral colony by species (column "BR" in the "2. Non-ESA RelocatedColony Info" data sheet). The sum can be calculated by using the sum function (=sum(BR#start:BR#end)) in Excel – record the summed amount for each species type identified in Column B. for each relocation site.
K. 2 Year Monitoring (Pooled Coral Live Tissue Area Index) – "sum" the Live Tissue Area Indices auto-calculated for each coral colony by species (column "CG" in the "2. Non-ESA RelocatedColony Info" data sheet). The sum can be calculated by using the sum function (=sum(CG#start:CG#end)) in Excel – record the summed amount for each species type identified in Column B. for each relocation site.

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L. Change in pooled Live Tissue Area Index – this will auto-populate once Columns H, I, J and K are filled in to provide any changes in the pooled live tissue area index by each species and site.
M. Overall 6 Mo. Survival (%) – the formula provided in Column M can be used to calculate overall survival after pooling each species in data sheet "2. Non-ESA RelocatedColony Info", and using the "countif" function to count the number of corals of the same species with a Coral Tissue Condition % Live greater than zero in column BA. Counts can be calculated by using the countif function in Excel using the data range in column BA for each pooled species for each relocation site. The countif function is (=countif(BA#start:BA#end, ">0")) where the range of data to count is in Column BA starting with first row of a relocated colony and ending with the last row of a relocated colony for a pooled species. The species should be sorted to facilitate this. For example, if data for one species are located in rows 6-20 and data for another species are in rows 21-35, the formula would be "=countif(BA6:BA20, ">0")" for the first species and "=countif(BA21:BA35, ">0")" for the second species. Next, in data sheet "1. Non-ESA Relocations Summary", replace the "countif" portion of the formula (e.g.; (countif(BA#start:BA#end, ">0")) in Column M with the number of corals with a Coral Tissue Condition % Live greater than zero calculated in datasheet "2. Non-ESA RelocatedColony Info" to calculate the overall survival. The number will then auto-populate.
N. The sum can be calculated by using the sum function in Excel using the data range in column R for each pooled species for each relocation site as identified in Column B. The sum function is (=sum(Rstart:R#end)) where the range of data to sum is in column R starting with first row of a relocated colony and ending with the last row of a relocated colony for a pooled species. The species should be sorted to facilitate this. For example, if data for one species are located in rows 6-20 and data for another species are in rows 21-35, the formula would be "=sum(R6:R20)" for the first species and "=sum(R21:R35)" for the second species.
O. Overall 1 Year Survival (%) – the formula provided in Column N can be used to calculate overall survival after pooling each species in data sheet "2. Non-ESA RelocatedColony Info" and using the "countif" function (=countif(BP#start:BP#end)) to count the number of corals with a Coral Tissue Condition % Live greater than zero in column BP. In data sheet "1. Non-ESA Relocations Summary", replace the "countif" portion of the formula in Column N with the number of corals with a Coral Tissue Condition % Live greater than zero to calculate the overall survival. The number will then auto-populate.
P. Overall 2 Year Survival (%) – the formula provided in Column O can be used to calculate overall survival after pooling each species in data sheet "2. Non-ESA RelocatedColony Info" and using the "countif" function (=countif(CE#start:CE#end)) to count the number of corals with a Coral Tissue Condition % Live greater than zero in column CE. In data sheet "1. Non-ESA Relocations Summary", replace the "countif" portion of the formula in Column O with the number of corals with a Coral Tissue Condition % Live greater than zero to calculate the overall survival. The number will then auto-populate.
Q. Notes – document any additional information deemed relevant by the license holder.
R. Removal Site Location Description – provide a brief description of where the removal site is located.
S. Removal Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the removal site.
T. Removal Site Depth – provide the depth (in feet) of the removal site.

- Columns T. through AJ. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the removal site. Provide all formats required by all permits for reporting requirements.

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★ The following columns AK. through BD. apply to temporary holding sites (e.g., cache, staging, acclimation). Only provide data for these columns if corals will not be directly relocated and a temporary holding site will be used. Record a value of zero if not applicable.

AK. Temporary Holding Site Location Description – provide a brief description of where the temporary holding site is located. If the temporary holding site is land-based, information for this column should include name of facility operator, affiliation, and address.

AL. Temporary Holding Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the temporary holding site.

AM. Temporary Holding Site Depth – provide the depth (in feet) of the temporary holding site (record a value of zero for land-based site).

- Columns AN. through BD. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the temporary holding site. Provide all formats required by all permits for reporting requirements. Record a value of zero for land-based temporary holding sites.

BE. Relocation Site Location Description – provide a brief description of where the relocation site is located.

BF. Relocation Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the relocation site.

BG. Relocation Site Depth – provide the depth (in feet) of the relocation site.

- Columns BH. through BX. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the relocation site. Provide all formats required by all permits for reporting requirements.

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2. Non-ESA Listed Relocated Coral Colony Information Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "2. Non-ESA RelocatedColony Info" data sheet, record the following information PER INDIVIDUAL COLONY for all relocated colonies that are being monitored:

At Relocation:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

A. Event Date – provide the date that the colony was removed.
B. Removal Site Identifier – provide the unique operational name/number/alphanumeric character assigned to the removal site, as identified in the "1. Non-ESA Relocations Summary" data sheet.
C. Temporary Holding Site Identifier - provide the unique operational name/number assigned to the temporary holding site, as identified in the "1. Non-ESA Relocations Summary" data sheet.
D. Relocation Site Identifier – provide the unique operational name/number assigned to the relocation site, as identified in the "1. Non-ESA Relocations Summary" data sheet.
E. Coral Species Name – record each relocated coral by the species full taxonomic name (no abbreviations) on a separate row. Group same species together to facilitate determining "Coral Live Tissue Area Index" and "Overall Survival" metrics in the 1. Non-ESA Coral Summary data sheet (e.g., all MCAVs grouped in lines 6 - 30; all PSTRs grouped in lines 31-45, etc.)
F. Colony Identifier – record the unique tag or map number/alphanumeric character assigned to each coral being monitored.
G. Coral Relocation Condition – record if the colony was removed and relocated as an (I) = Intact Colony; or as a (RC) = Reconstructed Colony (i.e., colony that fragmented upon removal and was reconstructed on reattachment.)
H. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "3. Non-ESA Diseased Colony Info" data sheet.
I. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.
J. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.
K. Coral Skeletal Area – this will auto-populate, and is equal to the average of the two largest dimensions (maximum width and maximum height), squared. To apply this formula to all of the data in this column, you have two options: 1) drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded; or 2) copy and paste the formula for each colony's data recorded.
L. Coral Tissue Condition – % Live – Includes all live tissue, including any bleached tissue (pale or clear living tissue that has lost zooxanthellae), estimated as a percentage of the entire coral

skeleton. Assign a tissue condition percentage for live tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

M. Coral Tissue Condition – % Dead – Includes both recent and old dead tissue; defined as either 1) bright white dead areas where corallite structure is still identifiable, estimated as a percentage of the entire coral skeleton. May be covered by sediment or thin layer of algae; or 2) dead areas that are not bright white and may be overgrown with algae or other encrusting organisms, estimated as a percentage of the entire coral skeleton. Assign a tissue condition percentage for dead tissue, and record as a decimal, with two decimal places – e.g., 10% = .10
N. Coral Live Tissue Area Index (or estimate) – this will auto-populate, and is equal to the Skeletal Area times the % live tissue value. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.
O. Comments/Observations – Document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., severe weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.
P. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.
Q. % Cloud Cover – record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.
R. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+
S. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

<u>One Week After Relocation:</u>

T. Event Date – provide the date that the colony was monitored.
U. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.
V. % Cloud Cover – record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.
W. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+
X. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25
Y. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in data sheet 5. Diseased Coral Colony Info.

<u>At One Month After Relocation:</u>

Z. Event date – provide the date that the colony was monitored.
AA. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.
AB. % Cloud Cover - record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.
AC. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+
AD. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25
AE. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed

during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "3. Non-ESA Diseased Colony Info" data sheet.

AF. Sediment Indicators – Record any indicators of sedimentation as follows:
- (SD) = Sediment Dusting - A fine powdering of sediment observable on the surface of the colony or individual. May occur in patches or over the entire organism. Powdering does not obscure features of the colony or individual (i.e., polyps are still observable).
- (SA) = Sediment Accumulation - Patches (areas) of sediment thicker than dusting are observable on the top or sides of the organism. Features of the colony or individual (i.e., polyps) are likely obscured by sediment patches.
- (PB) = Partial Burial - Portions of the organism are covered by sediment, including at least some portion of the base (point of attachment). Features of colonies and individuals are obscured.
- (BB) = Burial of the Base - Sediment covers the entire point of attachment / base of the organism.
- (CB) = Complete Burial - Entire organism is covered by sediment.
- (SH) = Sediment Halo - A pattern of partial colony mortality in which a concentric ring of dead coral skeleton occurs at the base of the coral colony, as results from prior burial of the colony edges. Sedimentation does not have to be present or observed for this indicator to be discernible.

AG. Presence of Other Conditions – record the following observed conditions: bleaching, disease, predation (active or inactive), *Cliona*.

AH. Comments/Observations – Document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

<u>At Three Months After Relocation</u>

Repeat columns Z. through AH. for columns AI. through AQ.

<u>At Six Months After Relocation:</u>

AR. Event date – provide the date that the colony was monitored.

AS. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.

AT. % Cloud Cover - record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.

AU. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+

AV. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

AW. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "3. Non-ESA Diseased Colony Info" data sheet.

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AX. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.

AY. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.

AZ. Coral Skeletal area – this will auto-populate, and is equal to the average of the two largest dimensions (maximum width and maximum height), squared. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.

BA. Coral Tissue Condition – % Live – Includes all live tissue, including bleached tissue, estimated as a percentage of the entire coral skeleton. Assign a tissue condition percentage for live tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

BB. Coral Tissue Condition – % Dead – Includes both recent and old dead tissue; defined as either 1) bright white dead areas where corallite structure is still identifiable, estimated as a percentage of the entire coral skeleton. May be covered by sediment or thin layer of algae, or 2) dead areas that are not bright white and may be overgrown with algae or other encrusting organisms, estimated as a percentage of the entire coral skeleton. Assign a tissue condition percentage for dead tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

BC. Coral Live Tissue Area Index (or estimate) – this will auto-populate, and is equal to the Skeletal Area times the % live tissue value. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.

BD. Sediment Indicators – Record any indicators of sedimentation as follows:

- (SD) = Sediment Dusting - A fine powdering of sediment observable on the surface of the colony or individual. May occur in patches or over the entire organism. Powdering does not obscure features of the colony or individual (i.e., polyps are still observable).
- (SA) = Sediment Accumulation - Patches (areas) of sediment thicker than dusting are observable on the top or sides of the organism. Features of the colony or individual (i.e., polyps) are likely obscured by sediment patches.
- (PB) = Partial Burial - Portions of the organism are covered by sediment, including at least some portion of the base (point of attachment). Features of colonies and individuals are obscured.
- (BB) = Burial of the Base - Sediment covers the entire point of attachment / base of the organism.
- (CB) = Complete Burial - Entire organism is covered by sediment.
- (SH) = Sediment Halo - A pattern of partial colony mortality in which a concentric ring of dead coral skeleton occurs at the base of the coral colony, as results from prior burial of the colony edges. Sedimentation does not have to be present or observed for this indicator to be discernible.

BE. Presence of Other Conditions – record the following observed conditions: bleaching, disease, predation (active or inactive), *Cliona*.

BF. Comments/Observations – document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

At One Year After Relocation
Repeat columns AR. through BF. for columns BG. through BU.

At Two Years After Relocation
Repeat columns AR. through BF. for columns BV. through CJ.

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3. Non-ESA Listed Diseased Coral Colony Information Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "3. Non-ESA Diseased Colony Info" data sheet, record the following information PER INDIVIDUAL COLONY of non- ESA listed coral species that were not relocated or reattached due to disqualifying conditions:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

A. Event Date – provide the date that the colony was monitored.
B. Removal Site Identifier – provide the unique operational name/number/alphanumeric character assigned to the removal site, as identified in data sheet "1. Non-ESA Relocations Summary".
C. Temporary Holding Site Identifier (if applicable) – provide the unique operational name/number/ alphanumeric character assigned to the temporary holding site, as identified in data sheet "1. Non-ESA Relocations Summary".
D. Relocation Site Identifier – if the coral became detached at the Relocation Site, was not reattached and was disposed of on land or donated, provide the unique operational name/number/alphanumeric character assigned to the relocation site, as identified in data sheet "1. Non-ESA Relocations Summary".
E. Coral Species Name – record each diseased coral by the species full taxonomic name (no abbreviations) on a separate row.
F. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.
G. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.
H. Disposition – identify what happened to the coral as: DNR = Did not remove from original removal site; DIS = Removed from temporary holding or relocation site and disposed of on land; DON = Removed from any site and donated.
I. Colony Identifier – if the coral became detached at the Relocation Site, was not reattached and was disposed of or donated, provide the Colony Identifier.
J. Coral Disqualifier – identify what condition disqualified the coral colony from relocation or reattachment, using the key code provided. *Note - Stress indicators do not disqualify corals from being relocated from interior waterways unless 100% bleached. Predators must be removed prior to relocation and are also not a disqualifying condition.
K. Type of Coral Disqualifying Stress Indicator – if the coral was disqualified from relocation or reattachment due to a stress indicator, use the key code provided to identify the stress indicator that disqualified the coral. *Note - Stress indicators do not disqualify corals from being relocated from interior waterways unless 100% bleached.
L. Type of Recent Mortality: if the coral was disqualified from relocation or reattachment due to recent mortality, use the key code provided to identify the type/amount of recent mortality that disqualified the coral.
M. Type of Coral Disqualifying Active Disease or Suspect Disease Indicator – if the coral was disqualified from relocation or reattachment due to an active disease or suspect disease indicator, use the key code provided to identify the disease or disease indicator that disqualified the coral.

N. Type of Coral Disqualifying Competition/Overgrowth Condition – if the coral was disqualified from relocation or reattachment due to competition or overgrowth, use the key code provided to identify the predation, competition or overgrowth condition that disqualified the coral. *Note - Predators must be removed prior to relocation and are not a disqualifying condition.

O. Comments/Observations - provide any comments or observation details for unknown diseases or conditions, name of entity that diseased corals were donated to (if donated), and any other information deemed relevant by the data collector.

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4. ESA-Listed Species Site Descriptions Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "4. ESA Site Descriptions" data sheet, record the following information PER INDIVIDUAL COLONY for all relocated colonies that are being monitored:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

A. ESA-Listed Coral Species – record each relocated species type (not by individual coral) by relocation site on a separate row.
B. Removal Site Location Description – provide a brief description of where the removal site is located.
C. Removal Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the removal site.
D. Removal Site Depth – provide the depth (in feet) of the removal site.

- Columns E. through U. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the removal site. Provide all formats required by all permits for reporting requirements.

★ The following columns V. through AO. only apply to temporary holding sites (e.g., cache, staging, acclimation). Only provide data for these columns if ESA-listed corals will not be directly relocated, and a temporary holding site will be used. Provide a value of zero if not applicable.

V. Temporary Holding Site Location Description – provide a brief description of where the temporary holding site is located.
W. Temporary Holding Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the temporary holding site.
X. Temporary Holding Site Depth – provide the depth (in feet) of the temporary holding site.

- Columns Y. through AO. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the temporary holding site. Provide all formats required by all permits for reporting requirements.

AP. Relocation Site Location Description – provide a brief description of where the relocation site is located.
AQ. Relocation Site Identifier – assign and provide a unique operational name/number/alphanumeric character for the relocation site.
AR. Relocation Site Depth – provide the depth (in feet) of the relocation site.

- Columns AS. through BI. – Refer to "Guideline A" on page 20 for directions on how to provide coordinates for the relocation site. Provide all formats required by all permits for reporting requirements.

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5. ESA-Listed Relocated Coral Colony Information Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "5. ESA Relocated Colony Info" data sheet, record the following information PER INDIVIDUAL COLONY for all relocated colonies that are being monitored:

At Relocation:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

AA. Event Date – provide the date that the colony was removed.

BB. Removal Site Identifier – provide the unique operational name/number/alphanumeric character assigned to the removal site, as identified in the "4. ESA Site Descriptions" data sheet.

CC. Temporary Holding Site Identifier - provide the unique operational name/number assigned to the temporary holding site, as identified in the "4. ESA Site Descriptions" data sheet.

DD. Relocation Site Identifier – provide the unique operational name/number assigned to the relocation site, as identified in the "4. ESA Site Descriptions" data sheet.

EE. Coral Species Name – record each relocated coral by the species full taxonomic name (no abbreviations) on a separate row. Group the same species together to facilitate determining the Coral Live Tissue Area Index (e.g., all ACERs grouped in lines 6 - 30; all OFAVs grouped in lines 31-45, etc.)

FF. Colony Identifier – record the unique tag or map number/alphanumeric character assigned to each coral being monitored.

GG. Coral Relocation Condition – record if the colony was removed and relocated as an (I) = Intact Colony; or as a (RC) = Reconstructed Colony (i.e., colony that fragmented upon removal and was reconstructed on reattachment.)

HH. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "6. ESA Diseased Colony Info" data sheet.

II. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.

JJ. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.

KK. Coral Skeletal Area – this will auto-populate, and is equal to the average of the two largest dimensions (maximum width and maximum height), squared. To apply this formula to all of the data in this column, you have two options: 1) drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded; or 2) copy and paste the formula for each colony's data recorded.

LL. Coral Tissue Condition – % Live – Includes all live tissue, including any bleached tissue (pale or clear living tissue that has lost zooxanthellae), estimated as a percentage of the entire coral

skeleton. Assign a tissue condition percentage for live tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

MM. Coral Tissue Condition – % Dead – Includes both recent and old dead tissue; defined as either 1) bright white dead areas where corallite structure is still identifiable, estimated as a percentage of the entire coral skeleton. May be covered by sediment or thin layer of algae; or 2) dead areas that are not bright white and may be overgrown with algae or other encrusting organisms, estimated as
a percentage of the entire coral skeleton. Assign a tissue condition percentage for dead tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

NN. Coral Live Tissue Area Index (or estimate) – this will auto-populate, and is equal to the Skeletal Area times the % live tissue value. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.

OO. Comments/Observations – Document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., severe weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

PP. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.

QQ. % Cloud Cover – record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.

RR. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+

SS. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

<u>One Week After Relocation:</u>

TT. Event Date – provide the date that the colony was monitored.

UU. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.

VV. % Cloud Cover – record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.

WW. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+

XX. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

YY. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "6. ESA Diseased Colony Info" data sheet.

<u>At One Month After Relocation:</u>

ZZ. Event date – provide the date that the colony was monitored.

AA. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.

AB. % Cloud Cover - record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.

AC. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+

AD. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

AE. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed

during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "6. ESA Diseased Colony Info" data sheet.

AF. Sediment Indicators – Record any indicators of sedimentation as follows:
- (SD) = Sediment Dusting - A fine powdering of sediment observable on the surface of the colony or individual. May occur in patches or over the entire organism. Powdering does not obscure features of the colony or individual (i.e., polyps are still observable).
- (SA) = Sediment Accumulation - Patches (areas) of sediment thicker than dusting are observable on the top or sides of the organism. Features of the colony or individual (i.e., polyps) are likely obscured by sediment patches.
- (PB) = Partial Burial - Portions of the organism are covered by sediment, including at least some portion of the base (point of attachment). Features of colonies and individuals are obscured.
- (BB) = Burial of the Base - Sediment covers the entire point of attachment / base of the organism.
- (CB) = Complete Burial - Entire organism is covered by sediment.
- (SH) = Sediment Halo - A pattern of partial colony mortality in which a concentric ring of dead coral skeleton occurs at the base of the coral colony, as results from prior burial of the colony edges. Sedimentation does not have to be present or observed for this indicator to be discernible.

AG. Presence of Other Conditions – record the following observed conditions: bleaching, disease, predation (active or inactive), *Cliona*.

AH. Comments/Observations – Document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

<u>At Three Months After Relocation</u>

Repeat columns Z. through AH. for columns AI. through AQ.

<u>At Six Months After Relocation:</u>

AR. Event date – provide the date that the colony was monitored.

AS. Visibility – this is measured either from the surface, or between two divers, using a secchi disk.

AT. % Cloud Cover - record the percentage of cloud cover as 0-20; 20-40; 40-60; 60-80; 80-100.

AU. Wave Height – record the wave height in feet as <1; 1-2; 2-3; 3-4; 4-5; 5+

AV. Wind Speed – record the wind speed in knots as 0-5; 5-10; 10-15; 15-20; 20-25

AW. Attachment – conduct a visual survey for attachment condition of relocated colonies, and record condition status as (F) = Firm; (LR) = Loose and Reaffixed; (DR) = Detached and Reaffixed; (DD) = Detached and Disposed of on land; (M) = Missing. All loose colonies must be reaffixed during all monitoring events. Detached colonies must be visually reassessed for health and if they meet all health criteria, reaffixed to their structure or substrate during all monitoring events. Detached corals that do not meet all visual health assessment criteria should be removed and disposed of on land, and such disposition must be recorded in the "6. ESA Diseased Colony Info" data sheet.

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AX. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.

AY. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.

AZ. Coral Skeletal area – this will auto-populate, and is equal to the average of the two largest dimensions (maximum width and maximum height), squared. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.

BA. Coral Tissue Condition – % Live – Includes all live tissue, including bleached tissue, estimated as a percentage of the entire coral skeleton. Assign a tissue condition percentage for live tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

BB. Coral Tissue Condition – % Dead – Includes both recent and old dead tissue; defined as either 1) bright white dead areas where corallite structure is still identifiable, estimated as a percentage of the entire coral skeleton. May be covered by sediment or thin layer of algae, or 2) dead areas that are not bright white and may be overgrown with algae or other encrusting organisms, estimated as a percentage of the entire coral skeleton. Assign a tissue condition percentage for dead tissue, and record as a decimal, with two decimal places – e.g., 10% = .10

BC. Coral Live Tissue Area Index (or estimate) – this will auto-populate, and is equal to the Skeletal Area times the % live tissue value. Please copy and paste the formula for each colony's data recorded, or drag the formula down the column by clicking in the cell in row 6 with the value of "0", and dragging the green box in the lower right hand corner of the cell down to the last colony that has data recorded.

BD. Sediment Indicators – Record any indicators of sedimentation as follows:

- SD) = Sediment Dusting - A fine powdering of sediment observable on the surface of the colony or individual. May occur in patches or over the entire organism. Powdering does not obscure features of the colony or individual (i.e., polyps are still observable).
- (SA) = Sediment Accumulation - Patches (areas) of sediment thicker than dusting are observable on the top or sides of the organism. Features of the colony or individual (i.e., polyps) are likely obscured by sediment patches.
- (PB) = Partial Burial - Portions of the organism are covered by sediment, including at least some portion of the base (point of attachment). Features of colonies and individuals are obscured.
- (BB) = Burial of the Base - Sediment covers the entire point of attachment / base of the organism.
- (CB) = Complete Burial - Entire organism is covered by sediment.
- (SH) = Sediment Halo - A pattern of partial colony mortality in which a concentric ring of dead coral skeleton occurs at the base of the coral colony, as results from prior burial of the colony edges. Sedimentation does not have to be present or observed for this indicator to be discernible.

AG. Presence of Other Conditions – record the following observed conditions: bleaching, disease, predation (active or inactive), *Cliona*.

AH. Comments/Observations – Document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

BE. Presence of Other Conditions – record the following observed conditions: bleaching, disease, predation (active or inactive), *Cliona*.

BF. Comments/Observations – document any localized event (not specific to relocated corals) that may have negative impacts on the relocation site (e.g., weather event, grounding, sedimentation, disease, regional bleaching, predation, competition), and document any other information deemed relevant by the data collector.

At One Year After Relocation

Repeat columns AR. through BF. for columns BG. through BU.

At Two Years After Relocation

Repeat columns AR. through BF. for columns BV. through CJ.

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6. ESA Listed Diseased Coral Colony Information Data Sheet Directions

***Reminder – a separate set of all applicable data sheets should be filled out for each relocation site (data sheets 1-3 for non-ESA listed corals and 4 – 6 for ESA-listed corals).**

In the "6. ESA Diseased Colony Info" data sheet, record the following information PER INDIVIDUAL COLONY of ESA listed coral species that were not relocated or reattached due to disqualifying conditions:

- Row 2: Provide the project name, FWC license number, person the license is issued to, and affiliation.

P. Event Date – provide the date that the colony was monitored.

Q. Removal Site Identifier – provide the unique operational name/number/alphanumeric character assigned to the removal site, as identified in data sheet "1. Non-ESA Relocations Summary".

R. Temporary Holding Site Identifier (if applicable) – provide the unique operational name/number/ alphanumeric character assigned to the temporary holding site, as identified in data sheet "1. Non-ESA Relocations Summary".

S. Relocation Site Identifier – if the coral became detached at the Relocation Site, was not reattached and was disposed of on land or donated, provide the unique operational name/number/alphanumeric character assigned to the relocation site, as identified in data sheet "1. Non-ESA Relocations Summary".

T. Coral Species Name – record each diseased coral by the species full taxonomic name (no abbreviations) on a separate row.

U. Coral Max Width – the maximum coral width is measured as the outward-facing surface of the colony (perpendicular to the axis of growth). This measurement includes both living tissue and dead areas of the colony.

V. Coral Max Height – the maximum coral height is measured parallel to the axis of growth, perpendicular to growth bands, as viewed from the side of the colony.

W. Disposition – identify what happened to the coral as: DNR = Did not remove from original removal site; DIS = Removed from temporary holding or relocation site and disposed of on land; DON = Removed from any site and donated.

X. Colony Identifier – if the coral became detached at the Relocation Site, was not reattached and was disposed of or donated, provide the Colony Identifier.

Y. Coral Disqualifier – identify what condition disqualified the coral colony from relocation or reattachment, using the key code provided. *Note - Stress indicators do not disqualify corals from being relocated from interior waterways unless 100% bleached. Predators must be removed prior to relocation and are also not a disqualifying condition.

Z. Type of Coral Disqualifying Stress Indicator – if the coral was disqualified from relocation or reattachment due to a stress indicator, use the key code provided to identify the stress indicator that disqualified the coral. *Note - Stress indicators do not disqualify corals from being relocated from interior waterways unless 100% bleached.

AA. Type of Recent Mortality: if the coral was disqualified from relocation or reattachment due to recent mortality, use the key code provided to identify the type/amount of recent mortality that disqualified the coral.

BB. Type of Coral Disqualifying Active Disease or Suspect Disease Indicator – if the coral was disqualified from relocation or reattachment due to an active disease or suspect disease indicator, use the key code provided to identify the disease or disease indicator that disqualified the coral.

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CC. Type of Coral Disqualifying Competition/Overgrowth Condition – if the coral was disqualified from relocation or reattachment due to competition or overgrowth, use the key code provided to identify the predation, competition or overgrowth condition that disqualified the coral. *Note - Predators must be removed prior to relocation and are not a disqualifying condition.

DD. Comments/Observations - provide any comments or observation details for unknown diseases or conditions, name of entity that diseased corals were donated to (if donated), and any other information deemed relevant by the data collector.

Florida Fish and Wildlife Conservation Commission (FWC)
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Guideline A

Coordinates – There are four options for providing coordinates for the removal site, temporary holding site, and relocation site. These options are designed to meet regulatory requirements (as specifically required by any agency permit or Biological Opinion (BO)), accommodate for site design and activity size (if a specific format is not required by agency permits), and provide accuracy for permit enforcement purposes (all formats accommodate this). Provide any and all of the formats that are necessary to meet all regulatory requirements for all project-issued permits (first), and if a format is not specified in any permit, then provide the format that best fits the site design and activity (second). It is not necessary to provide all four formats unless required by permits. The four options are as follows:

- Single Point – Single point coordinates are usually required in most BOs for listed species, but may also be appropriate for use in smaller scale relocation activities. It is likely that if relocation activities include both listed and non-listed species, you will need to provide both single point coordinates for the listed species, and some other format for non-listed species. Provide the latitude and longitude (separate columns) of the single point coordinate in decimal degree format.
- Linear – Linear coordinates may be appropriate for use when the site is in somewhat of a straight line (e.g., seawall, rip rap). Provide the latitude and longitude (separate columns) of the beginning point and the end point of the site in decimal degree format.
- Corners – Some permits require a single point coordinate of each corner of a site to be provided, regardless of the design of the site. Provide the latitude and longitude (separate columns) of the single point coordinates of the NE, NW, SE, SW corners of the site, in decimal degree format.
- Undefined – Undefined coordinates may be appropriate for use when the site design is undefined (i.e., random, opportunistic). Provide the latitude and longitude (separate columns) of the single center point coordinate in decimal degree format, and a radius (in meters) from the single center point that will encompass the site.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Florida Keys National Marine Sanctuary
33 East Quay Road
Key West, Florida 33040

Florida Keys National Marine Sanctuary
Resource Survey Assessment Protocols for Nearshore Construction Projects
Report Checklist

Overall Site

☐ Site description and location (GPS coordinates (decimal degrees) and street address).

☐ Date of survey, time of day, weather conditions, tidal state, underwater visibility estimate (in feet or meters), water depth, and name of surveyor(s).

☐ Description of methods used for surveying site and assessing potential resource impacts.

☐ Explanation of areas surveyed, areas not surveyed, and rationale for both.

☐ Explanation of buffer area size and rationale.

☐ General description of the entire property with an assessment as to whether the proposed location contains the least resources and is therefore most appropriate for the structure.

☐ Summary discussion of all resources that will be impacted and recommendations for avoidance and minimization strategies to prevent or reduce impacts.

☐ Map of project site with locations of the area surveyed and clearly delineating the locations of stony corals, seagrasses, mangroves, and other invertebrates such as soft coral/octocoral (e.g., sea fans, sea whips, sea plumes, sea rods), sponges, macroalgae/SAV, fauna, etc. in relation to the proposed work.

☐ Photographs of individual coral colonies, or clusters of coral encrustations, and other resources observed. If corals are too abundant to document each individual, photo-documentation of large, prominent colonies and/or areas of dense cover are recommended. Photograph quality must be of acceptable resolution.

Stony Coral Resources

In project footprint/impact area, the total number (binned by size class) and area by species of stony coral:

☐ On natural substrate that will be impacted by the project and cannot be relocated with clear rationale for why corals are not recommended for relocation (if applicable).

☐ On structures being repaired/replaced that will be impacted by the project and cannot be relocated with clear rationale for why corals are not recommended for relocation (if applicable).

☐ On natural substrate that are candidates for relocation.

☐ On structures being repaired/replaced that are candidates for relocation.

☐ On debris that is not part of the project and a description of the debris.

In buffer area, the total number (binned by size class) and area by species of stony coral:

☐ On natural substrate that cannot be relocated and an assessment of whether relocation or marking and avoidance with post-construction fate tracking is recommended.

☐ That are candidates for relocation and an assessment of whether relocation or marking and avoidance with post-construction fate tracking is recommended.

☐ That are located on debris that is not part of the project and a description of the debris.

☐ Table(s)/spreadsheets containing all data above. FKNMS may require data in Excel format for projects with numerous resources.

Soft Coral/Octocoral and Sponge Resources

In project footprint/impact area, the total number (binned by size class) and area by genus of soft corals/octocorals and sponges:

☐ On natural substrate that will be impacted by the project.

☐ On structures being repaired/replaced that will be impacted by the project.

☐ On debris that is not part of the project.

☐ Discussion and rationale as to whether any soft coral/octocoral or sponge resources that will be impacted by the project are candidates for relocation.

In buffer area, the total number (binned by size class) and area by genus of soft corals/octocorals and sponges:

☐ On natural substrate, with discussion and rationale as to whether relocation or marking and avoidance with post-construction fate tracking is recommended.

☐ That are located on debris that is not part of the project and a description of the debris.

☐ Table(s)/spreadsheets containing all data above. FKNMS may require data in Excel format for projects with numerous resources.

Seagrass and Macroalgae/SAV Resources

☐ Percent cover, shoot density, and total area (ft^2 and m^2) by species of seagrass within the project footprint that will be impacted by the project.

☐ Percent cover, shoot density, and total area (ft^2 and m^2) by species of seagrass within the buffer area and an assessment of whether marking and avoidance with post-construction fate tracking is recommended.

☐ Percent cover, total area (m^2), and species composition of macroalgae/SAV within the project footprint that will be impacted by the project.

Mangrove and Buttonwood Resources

☐ Total area (ft^2 and m^2) by species of mangrove or buttonwood within the project footprint that will be impacted by the project.

☐ Total area (ft^2 and m^2) by species of mangrove or buttonwood within the buffer area and an assessment of whether marking and avoidance with post-construction fate tracking is recommended.

ESA Listed Species and Critical Habitat

☐ Document and quantify, as appropriate, the presence of any ESA threatened or endangered species.

☐ Document and quantify, as appropriate, the presence of any ESA designated critical habitat and whether or not essential features are present.

Hardbottom Habitat

☐ Document the presence of any hardbottom habitat meeting the definitions in the U.S. Army Corps of Engineers Jacksonville District's Biological Opinion (JAXBO) and/or South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (2020 SARBO).

Cultural/Historical Resources

☐ Document the presence of any cultural or historical resources present within project footprint or buffer area.

☐ Provide a description and photographs of any cultural or historical resources present.